The Builder.

VOL. LIII. No. 2322. SATURDAY, AUGUST 6, 1887.

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The Panama Canal Report.

CONTRARY to the usual custom, the Committee of Management of the Panama Canal have issued an extra number of the *Bulletin*, containing the report presented to the annual meeting of the shareholders on the 21st July. We are thus in possession of the accounts a few days earlier than we anticipated. They come down, however, only to 30th June, 1886.

At that date it is stated that the total expenditure of the company amounted to 640 millions of francs, or 25,600,000*l*., and the *actif disponible*, or available funds, to 132½ millions of francs. But these two items, of which alone M. de Lesseps takes notice, are very far from representing the liability incurred by the company to that date. To their aggregate has to be added the rebate, or discount, at which the loans of 1882, '83, and '84 have been issued, which raises the debit of the company, on 30th June, 1886, to 39¾ millions sterling. To this have to be added the figures of the loan of 1886, involving a debt of 18 millions sterling and of a loan to an equal amount announced for issue in July, 1887. If this loan is placed, the published liabilities of the company will amount to 75½ millions sterling.

As to what has been done for that portion of this immense sum which is brought to book in the present report, there is a great silence. For a considerable period the *Bulletin du Canal Interocéanique* published monthly telegrams stating the amount of excavation done in the preceding month. That good habit has been abandoned; and it takes a considerable amount of research to arrive at the fact that the total quantity of earthwork returned as excavated from the commencement of the undertaking to the 30th of June, 1885, was 14,260,000 cubic mètres, of which rather more than half had been done in the year then closing. The total sum expended in that year on management and work in the Isthmus was 88 millions of francs, showing a cost of 11½ francs per cubic mètre excavated in the year. In 1885-6 only 78 million of francs are carried to account under the same heading, so that it is not probable that more than seven or eight millions of cubic mètres of excavation were done during that year, instead of the 24 millions of the programme. As to the work of 1886-7, we are still more in the dark.

The total quantity of excavation required for the canal was stated by M. de Lesseps in 1879 at 46,150,000, in 1880 at 75,000,000, and in 1883 at 120,000,000 cubic mètres. There are, however, some grounds for questioning whether even the last-named figures are at all a reliable maximum. Herr Beyeler, in October 1886, on data furnished by the officers of the canal, gives a quantity of 150,000,000 cubic mètres. In this case the total volume is divided into the contents of the twelve sections comprised in the line, and 20,000,000 is allowed for river diversions. But even here it must be remarked that the deepest cutting, that at Culebra, is set down as containing 25,000,000 cubic mètres within a length of two kilomètres. The axis of the canal here crosses the water-shed which separates the valley of the Obispo from that of the Rio Grande, at the lowest point, which is 100 mètres above the level of the sea. But the summits rise on either side to 120 and 190 mètres respectively, and allowing only 1 to 1 slopes (which for clay and sand exposed to a rainfall of 170 in., is a very questionable allowance), the deepest part of this cutting attains a depth, on the eastern slope, of 557 ft. 9 in., and one of 425 ft. 9 in. on the western slope. As a mere calculation on paper, 33 millions come nearer the mark than 25 millions for the contents of this cutting. And what it would ultimately prove that it would be necessary to remove, in order to open and maintain a sea-level trench through this treacherous hill, he must be a bold man who would even presume to guess.

In the same way it is easy to see that the estimate cited by Herr Beyeler of 20 millions of cubic mètres for river diversions is wholly inadequate. The river Chagres crosses the axis of the canal at the 45th kilomètre from Colon, the bed of the river at the point being 74 ft. above that proposed for the canal. In heavy floods,—as, for instance, in 1879,—the Chagres is known to rise 40 ft. above its ordinary level. Its volume at such a time is estimated by M. Dingler, one of the ablest and best-trusted servants of the Canal Company, at 1,600 cubic mètres of water per second, or rather more than four times that of the Thames in flood. To allow such a cataract to pour into the canal, when dug, is of course impossible, as it would wreck and choke the whole channel from Matachin, the point of intersection, to the sea. The Chagres intersects the axis of the canal no fewer than twenty-nine times, finally leaving its course at about 8 kilomètres from Colon, and falling into the sea to the west, while it debouches from the east of the canal line. On the first crossing it unites with the Obispo, the volume of which we have not found stated in the publications of the company; and lower down it receives the Rio Trinidado, with a volume of 400 cubic mètres per second, from the west, and the Gatuncillo, of an equal volume, from the east, besides smaller affluents.

It is obvious that in order to maintain, under such circumstances, not only the navigation, but the bare existence of a sea-level canal, it is indispensable that two lateral canals should be constructed,—one on the west, to carry to the sea the waters of the Obispo, the Trinidado, and three other large affluents; and one on the east to receive the flow and the floods of the Chagres, the Gatuncillo, and eight other affluents, and to carry them into the sea to the east of the peninsula of Colon, without crossing the canal. The latter channel, however, must be so enormous that it has been proposed to regularise and delay the floods of the Chagres by forming a large dam where this river issues from the mountains. It was first proposed to erect this of masonry, but the foundation proving unreliable, the plan selected, up to the present time, has been to construct an earthen mole, 1,000 mètres long, 960 mètres wide at bottom, 240 mètres wide at top, and 40 mètres high, behind which the flood would expand into a large lake containing a thousand millions of cubic mètres of water. Sluices and culverts were to be constructed in connexion with this dam in order to draw off the water gradually at the rate of 400 cubic mètres per second. Even that flow, through a channel of the cross-section of the proposed maritime canal, would cause a current of the velocity of 6 ft. per second, independent of the waters of the affluents from the east. Thus, while making every allowance for the utilisation of such portions of the existing river channels as would fall in with the general plan, it is impossible to calculate the excavation necessary for the deviations of the Chagres and the Obispo, even after the construction of the regulating works at Gamboa, at less than from two to three times that of the volume required for the excavation of the maritime canal itself. From Colon to kilomètre 45 this excavation is estimated by the officers of the company at 42 millions of cubic mètres. The addition to be made to this mass for the river deviations, if no dam is made, must be much underestimated at 100 millions more, while only 20 millions are allowed not only for the deviations of the Chagres and of the Obispo, but also for that of the Rio Grande, on the Pacific slope of the Cordilleras.

In these two items alone, of the cutting at Culebra and of the river diversions on the Atlantic slope, the plans and contours published in volume v. of the *Bulletin du Canal Interocéanique* (pp. 996, 1000), give a sufficient amount of definite information as to levels and contours to lead to the conclusion that the estimated contents of 67 millions of cubic mètres of cutting for this 47 kilomètres of canal

specified would be more likely to be trebled than not before the work was complete and safe. As to the Pacific slope, much the same course of argument is applicable; and the remainder of the central mass of the hill, the sections of Obispo, Emperador, and Paraiso, are liable to the same class of comment as to the inadequacy of slopes set out at ½ to 1 for rock and 1 to 1 for soft material.

This question of the adequacy of the estimate of 150 millions cubic mètres of excavation for the completion of a sea-level canal, receives an unexpected support from the report made by M. de Lesseps on the 21st of July in the present year. "It is certain," he says, "that no human power can guarantee us against the unforeseen, which resides in the geological mysteries of the central mass." And he proceeds to order "the substitution of a simple bank, directing the waters of the Chagres towards the deviations, for the construction of one immense dam," as "one of the principal simplifications effected in the programme." Such a substitution, the reader will see, would involve increasing the excavation necessary for the Chagres deviation to at least a four-fold amount, so as to take away 1,600 cubic mètres per second, instead of 400.

The second "simplification" mentioned in the report is the abandonment of the tidal lock at Panama. The central siding of 5 kilomètres long on the canal is also to be abandoned, and the ports of Colon and of Panama are to be reduced to what is strictly necessary. It seems further that the dredging at the Colon end of the line, which at present has gone no lower in a vertical direction than the surface of the rock, where this makes its appearance under water, is to be taken as sufficient for the opening of the canal.

As to the lock, a reference is made to the statement, previously cited in the columns of the *Builder*, of the "conclusions of M. Bouquet de la Grye" as to the difference of level which may exist between the two oceans. As to that the evidence is contradictory. But it matters very little whether the mean tide level be or be not the same at the two ends of a canal forty-six miles long. What does matter is the range of the tide. There is no controverting the statement that at Panama this range varies from 20 ft. to 27 ft. Nor can there be any doubt that such a tidal movement would be destructive to any canal into which it was allowed free admission. To abandon the tidal lock at Panama is only in other words to abandon the idea of navigating the canal.

We have been anxious in the foregoing remarks to avoid two things,—one is the expression, and, indeed, as far as possible the entertainment, of any private opinion on the subject; the other is any tendency to prophesy. We have based each statement on the definite information furnished by the *Bulletin du Canal Interocéanique*, and by the statements signed by M. Ferdinand de Lesseps. In the absence of any statement, in this sixth annual report, of the work done and to be done, according to the estimates of the company, we have grave reasons, which every engineer can appreciate, for the conclusion that the last estimate so given of the latter, although three times as much as the first, leaves out of account important and, indeed, controlling features of the case. We have shown what was the last annual amount of excavation of which the company have afforded the data, viz., 7,660,000 cubic mètres in the year ending with June, 1885. We have shown that as to the sum for which the company are now responsible, if their obligations are reckoned at the price at which they have contracted to repay them, the present liability amounts to 57¾ millions sterling, which the issue of the loan now offered will raise to 75¾ millions sterling. How near that expenditure will bring us to the opening of a sea-level canal we leave to our readers to estimate.

New Welsh Chapel, London.—The Committee of Crosby-row Chapel have appointed Mr. Charles Evans to be architect for the new chapel about to be erected. The site selected is in Falmouth-road, out of New Kent-road.

HARMONIC PROPORTIONS IN ARCHITECTURE.*

BY W. WATKISS LLOYD.

OCCASION has occurred in the article on the Propylæa† to observe how the greatest Greek architects were careful to subordinate a secondary structure to a superior which was in obvious relation to it,—the Propylæa of the Athenian Acropolis to the Parthenon,—and also the secondary to the superior members of the same structure,—the wings of the Propylæa to the central portico. These differences, we can see by the result, were designed with consummate art. The impression of the magnitude and dignity of the chief subject is enhanced very wonderfully, and yet those which are subsidiary still vindicate their appropriate importance. The smaller columns of the Pronaos and Posticum of the Parthenon come into view perspectively with those of the porticos in front of them, and tell with the same effect upon the sense of gradation.

We have an example always before us how resources are worse than wasted when this principle is neglected. The elevation of the British Museum would only gain in dignity if the architecture of the wings, by reduction of the scale of the columns, supported rather than detracted from the majesty of the central design. At present the elevation is provocative, — provocative even in an irritating sense,—of suggestions of relief. How would it do, one says, to advance the walls of the building and keep down these obtrusive lateral columns by engaging them? Would the façade be improved by taking them away altogether? What of a scheme to re-arrange them as interior supports of a grand hypostyle hall upon the now vacant area, and fronted nearer to the street by the portico re-erected and released from the competition of the bullying blocking course of the flanks? Subordination,—happy subordination,—is the principle of the very best effects of Gothic architecture no less than Greek, and the Greek may have learned his lesson by observation of some of the great Egyptian temples. But what the Greek is to be credited with as original and exclusive seems to be his appreciation of the value of accurate and numerically simple proportions in adjusting sequences of magnitudes of architectural members and distributions. Even so the adoption of this principle required to be supplemented by fine taste in correction of solid judgment, to decide both the stages of such gradations and between what several structural and ornamental terms they were to be fitly applied.

Dr. A. Zeising, as long ago as 1854, published at Leipsic an elaborate treatise on Proportion, and enunciated a theory which might not be worth adverting to except as a specimen of laborious error, and that it continues to be adverted to from time to time by German writers as worthy of the subject. He set forth that all excellent proportion, both in nature and art,—in the human frame and that of animals generally, in the leaves and growth of plants, in music and in architecture,—depends upon the division of quantities by the so-called golden section. In a line so divided by a simple geometrical problem, the smaller part bears to the larger the same proportion that the larger bears to the entire line; the larger part is then to be divided again on the same principle, and so at last a series of divisions are obtainable which give a good chance of hitting leading points of a composition more or less exactly.

But the proportions of such divisions to each other are not to be expressed in simple terms, and the applications of the system have no such significance and preciseness as to make it reasonable or plausible that the vast variety of simple numerical proportions should be renounced in its favour,—in favour of one inflexible rule.

No theory of proportion in art can be of value which does not admit of infinite variations of schemes and systems of proportion, —and which does not repudiate all pretensions to supply beauty automatically,—by the mere mechanical operation of a law. It is certain that the Greek architect had a definite theory; it is equally certain that he employed it as a musician may employ an instrument which he has perfectly in tune, with full confidence that it must depend upon his own judgment, taste, and manipulative skill whether he evokes from it harmony or discord. There is much appearance that the musical genius of the Greeks was far in advance of their musical science; that like many executants at the present and at all times, they could produce melodies which they could not write down,—and even that they explained some of their best successes not only imperfectly, but erroneously. It may have been much the same in architecture; the judge is proverbial who was always admirably correct in his decisions, and always grossly absurd in his account of how he arrived at and justified them. So it might be that the scheme of proportion employed by Ictinus in the Parthenon and by Mnesicles in the Propylæa had really nothing to do with their production of such admirable works; in this case, which is at least conceivable, the discovery of their system would have an historical interest, but not an artistic; it might be left to the students of pure archæology as a matter more of curiosity than of scientific value. Enough, however, has been recovered concerning it to prove that this is not the case; the system is so coherent in itself, is found to come into application so universally, and at the same time so consistently with rational proprieties, that it is impossible to refuse to it the credit of being a true and valuable instrument in the hands of those who evolved and who were capable of using it.

A further question may be reserved,—whether it is as available in the practice of design in other styles than the Greek? Or, at least, what are the extensions or restrictions, the limitations or the developments, which are required by the complication of modern circumstances in order to make it so? This is a very considerable inquiry indeed; but the field of inquiry as to proportion in art is essentially considerable,—it is one that had better be left aside altogether unless a becoming consciousness is entertained of its scope and comprehensiveness. Proportional laws control the solar system itself, and in their search for them astronomers have had their noblest successes and most disappointing defeats. We may leave them to do the best they can to find a substitute for Bode's discredited law, and turn off in a direction of our own from what was their, and has been in all ages, a common starting-point.

It is certified beyond question that the study of music first brought home to the philosophical sense of the Greeks the conviction that precise numerical proportions were not more closely related to the problems of geometry than to the reactions of physical nature on the one hand, and on the other to the excitement of æsthetic sympathetic emotion. To the same Pythagoras were ascribed,—whether rightly or not,—the discoveries of the numerical relations of the sides of right-angled triangles, the very charter of trigonometry, and of the dependence of musical concord,—the basis of sentimental expression,—on the specific quantities of weight, tension, and lengths of vibrating matter. As regards music, they held for the most part to the true philosophical course of grasping the principle of definite proportions between concordant strings, but of relying on accurate observation and experiment to decide its particular operation. Thus it was that the school of so-called Pythagoreans settled the musical scale, which is that of civilised nations, upon a truly scientific basis. Plato might be shocked at such concession to concrete matter of fact. He has nothing but sneers for the men who thought to elicit truth by "putting musical strings to the torture as if they were slaves under examination," and laid down their ears to catch minute differences of interval; to him it was below the dignity of philosophy to search for the secrets of musical harmony otherwise than by study of the nature of numbers in themselves. It was by this

* We are not, of course, responsible for the opinions expressed by Mr. Lloyd in this article.—Ed.

† See *Builder*, p. 3, *ante*.

false track that the wits of many,—and among them many so-called Pythagoreans,—went wool-gathering. It is quite possible that spurious theories of architectural proportion may have so originated, and even have gained so much vogue as in some instances to have governed practice. Xenophon, in the "Memorabilia," represents Socrates asking a young man who affected to despise instruction,—"If you proposed to be an architect should you not think it reasonable to provide yourself with a store of books on the subject?" There was, therefore, no lack of writers on architecture; and, we may assume without argument, no lack of conflicting theories, some of them, no doubt, wild or pretentious enough. Good and bad,—sane or supercilious merely,—all have alike perished. The only salvage from the wreck that can be hoped for is to be obtained from the study of the best remains, with the view to discover upon what theory their authors proceeded, and then with the resolution to put even these results to the best test of reasonableness that we can. We are bound to ask boldly, did the architects of such works as the Parthenon and Propylæa really find any true assistance in the proportionate theory which they are proved to have observed, or was it really indifferent to their success?

One of their applications of combined proportions has such remarkable analogy to the theory of musical chords that it is difficult to believe that we have in it only a case of casual coincidence. A musical triad consists of three notes, each of which is at a consonant interval from each of the others,—that is, any two notes of which taken together form a consonance. It will be seen at once that the case is directly analogous to a combination in architecture of three dimensions,—whether these are taken rectilinearly, that is, between three divisions of a straight line, or, more importantly, in the direction of the three dimensions of space,—the width, length, and height of an apartment, or of the exterior of a structure, which are presented quite as naturally in relation as the notes of the musical combination.

A protest is not unlikely to be heard here,—"the Greeks had no recognition of harmony,—they only regarded the consonance of notes in sequence,—not as sounded together." To such a protest the reply is open that a different opinion may be sustained on very substantial grounds. True it is that in what Greek treatises remain "De Re Musicâ," it would not be easy to find a definition of a chord,—but there are abundant classical passages which establish the fact (*vide* Chappell's History),—and this simple fact is enough, that those who tuned their instruments by sounding different strings together could not have been unaware of the value of the consonance of concurrent as well as of consecutive musical notes.

A consonance of three notes is that all-important constituent of harmony, the chord; and the principle of such consonance is the same both for the major and the minor scale.

The major scale supplies three perfect chords,—C, E, G; F, A, c; G, B, d, called respectively those of the tonic or key-note, the sub-dominant, and the dominant.

The agreeable effect which distinguishes such combinations is proved by experiment to depend on the number of vibrations which produce one note occupying precisely the same time as the different numbers of vibrations which produce the others. As matter of fact, six of the vibrations which produce the note G take place in the same time as five of the note E and four of C.

The same rule, but with different numbers, applies to the perfect chords of the minor scale,—A, C, E; D, F, a; E, G, b. In all these cases ten vibrations of the first note occupy the same time as twelve of the second and fifteen of the third.

Now it will be observed that both these systems agree in one respect, the index numbers of the concordant notes differ in the very simplest degree,—that is by unity.

Major concords..... 4 : 5 : 6
2 : 3

Minor concords ..... 10 : 12 : 15
5 : 6 4 : 5
2 : 3

The superior value of simplicity appears in the lower numbers which effectuate the major concords, and it is still more apparent in comparison of those of chords of inversion, on which it is not necessary here to enter.

It is enough to instance those of the first inversion of the tonic-major:—

12 : 15 : 20
4 : 5 3 : 4
3 : 5

In this combination one ratio varies by a difference (3 : 5) between its terms in excess of unity.

This, however, was a system of proportions which had some remarkable applications in early Greek architecture. I have shown, in the appendix to Mr. Cockerell's work on "Bassæ and Ægina," that the upper and lower diameters and breadth of abacus of the columns of both the temples at Ægina and of the very archaic temple at Corinth were so regulated by the terms 3, 4, 5.

Upper diameter	:	Lower do.	: : 3 : 4
Lower do.	:	Abacus	: : 4 : 5
Upper do.	:	do.	: : 3 : 5

It is probable that this early predilection for the terms 3, 4, 5, was due to a supposition of some especial value derived from the celebrated theorem of Pythagoras, these numbers being the simplest expression of the relation of the square of the hypothenuse of a right-angled triangle to the squares of the other two sides.

Later Greek architects decided that the diminution of the shaft thus obtained was far too quick, and adopted very different proportions; there is much appearance that they were guided in some important instances by proportions, not of diameters, but of the sectional areas of their columns above and below. In this connexion it is of interest to observe how early the notion of the squares of low numbers was brought into association with the designing of this important architectural member.

The Athenian example of the small temple on the Ilyssus furnishes us with what may be called a precise architectural chord; the upper diameter, 6 : lower diameter, 7 : breadth of abacus, 8.

6 : 7 : 8
3 : 4

The interior of the naos of this temple appears to have been an exact cube.

The largest dimensions which are brought into comparison are, of course, those of the height, length, and breadth of the temples on the exterior. Whether it was worth the while of the architects to bestow pains on effecting such precise adjustments is a matter with respect to which differences of opinion may possibly be entertained, and in any case it is worthy of discussion; but that such pains were bestowed can be fully established.

The small Doric temple of Artemis Propylæa at Eleusis had the proportions—full height of front, 4 : length of top step, 6 : breadth of ditto, 3 : giving the simple architectural chord:—

3 : 4 : 6
3 : 4 2 : 3
1 : 2

The constructive conditions enable us to recover the height of the naos interior, with fair probability, and we obtain,—

8 : 9 : 12
8 : 9 3 : 4
2 : 3

The temple of the Nike Apteros, as plausibly restored with pediment, gives the two following chords:—

Exterior 6 : 8 : 9
3 : 4 8 : 9
2 : 3

Interior 72 : 80 : 90
9 : 10 8 : 9
4 : 5

It will be observed that these comparisons are taken exclusively from structures of moderate dimensions; when we examine fine examples of larger scale we find that the architects, true to the suggestions and exigencies of their own art, break away from the simple rule of unitary differences which would be imposed by the law of the perfect musical chord. They do so in two directions: first in that which is indicated by the chords of inversion, which do not repudiate one ratio of the triad with a difference of terms greater than unity; and then by combining with uniform difference between terms, and so far with analogy to the perfect chord, an admission of difference in excess of unity, and higher numbers.

It must suffice to adduce the case of the Parthenon,—the grandest of all examples of proportional architecture,—and, considering the novelty of the exposition, it is fair to give verification of good faith by juxtaposition of the theoretical and executed dimensions,—the latter taken from Mr. Penrose's work on Athenian architecture.

65·147 : 101·341 : 228·147
9 : 14 4 : 9
2 : 7

			Measured.	Error.
2 : 7	Full height to length of top step.....	65·185 : 228·147	(228·141)	0·006
4 : 9	Breadth of top step : length of top step	101·341 : 228 017	(,,)	0·124
9 : 14	,, ,, : full height front.....	,, : 65·147	(65·185)	0·038

These three ratios, like those of the perfect chord in music, have a uniform difference between their terms, but a difference of five instead of only unity. They pertain to a scale or series, regulated by this common difference,—a scale which is exclusively resorted to throughout the design.

NOTES.

THE Channel Tunnel hobby was ridden again by Sir E. Watkin on Wednesday night, and defeated by 153 to 107; not so large a majority as we should have liked to have seen. There was the usual tall talk about patriotism and public spirit; qualities which have been so remarkably displayed in the whole course of Sir E. Watkin's public career, and his assumption of which in regard to this scheme will, no doubt, be estimated generally at its true value. As to the military dangers of the tunnel we have, of course, no right to speak, but we may say that we are hardly so convinced of their formidable character as some critics appear to be, and we should be disposed to agree with Sir Wilfrid Lawson that this class of objection to it has been exaggerated, and that for your enemy to get into a hole 20 ft. square was not the most favourable position for him to act against you. The real objections are the doubtful character of the strata, the probability of faults, the exceeding practical difficulty, not to say impossibility, of adequate ventilation, and the still greater improbability of the enterprise paying even if accomplished. There is another question which we and others have asked, and which Sir E. Watkin appears to carefully avoid: will the slight difference between the French and English gauge ($\frac{1}{4}$ in. in the North of France and $\frac{1}{2}$ in. in the South) materially interfere with the rolling-stock of one country running on the metals of the other? If that is so, the whole tunnel would be practically useless for economic conditions of traffic. It is all very well for the Chairman of Committees to

talk of "bogeyism" and "fogeyism," but Mr. Courtney is not an engineer, and political aspirations will not alter engineering facts.

THE defeat of Lord Stratheden and Campbell's Smoke Nuisance Abatement (Metropolis) Bill was a foregone conclusion, though we hardly expected so large a majority against it as 30 to 12, by which majority the Peers voted Earl Wemyss's amendment, that "before the law for the prohibition of smoke is extended to private dwellings, it is desirable that the purpose and intention of the existing Acts be more fully carried into effect, either by their amendment or by their better administration." On the subject of London fogs and smoke, the Earl of Crawford and Balcarres brought a little common sense to bear, observing that during the last Whitsuntide recess an excessively black fog had hung over London for twenty-four hours; that fog he traced back to Holland, whence it got to Dover, and eight hours later to London; it could not therefore be occasioned by London smoke. Other people might see as much if they would open their eyes and understandings to take in facts and their meaning. It would, no doubt, be better to have no smoke at all; but the passing of such a Bill as was proposed would simply result in a kind of tyranny over the domestic hearth worthy of the days of the curfew.

DR. KITTO, the Rector of St. Martin's-in-the-Fields, has forwarded to us a printed statement of his views in regard to the proposed alterations of the church, which, we see, also appeared in a slightly different form as a letter in the *Times* of Thursday. Dr. Kitto goes into all the suggestions which have been made in a most clear, sensible, and impartial manner, and comes to the following conclusions:—

"1. That no such necessity [for widening the roadway] can be shown to exist on the ground of public convenience, so far, at least, as the present is concerned.

2. That if anything is needed to be done, the improvement can afford to wait until that time comes when the National Gallery is dealt with.

3. If, however, it is thought that something ought to be done at once, I suggest that by carrying down the steps in one continuous flight on the east, or St. Martin's, side, and by the sacrifice of the unused steps on the National Gallery side, as much space will be gained as by the alteration which the Board proposes.

4. Only in the very last resort, when public convenience is seriously interfered with, and when every other remedy has been tried and proved to be insufficient, should any alteration be allowed in the front of St. Martin's Church."

In regard to the question of the interruption of traffic, Dr. Kitto points out that the omnibuses select this as a stopping-place, which they could not desire or be allowed to do if the traffic were thereby impeded; and that it has never been found necessary to place a policeman here to regulate the traffic; in fact, any one can see with his own eyes that there is no block,—there is only the possibility that there may be some day. If ever there should be, Dr. Kitto suggests, as we have done, that the end of the National Gallery, and not the fine portico of St. Martin's, would be the proper building to be modified and altered. We may quote also Dr. Kitto's dismissal of Mr. Butterfield's singular proposal to mutilate the portico:—

"Mr. Butterfield proposes to cut down the portico to half its depth, and he justifies this proposal on the ground that it is so shown in a model of the church in the possession of the parish. This is perfectly true, but what does it prove? Mr. Butterfield clearly does not appreciate the value of the evidence of his own witness. The model, obviously, was not made after the church was built, or it would have been made to correspond with it, and would accurately reproduce the portico. No doubt it is a model which was prepared beforehand from the plans of Gibbs, in order to show how the design would look when completed. And when it had been so prepared and considered, it was evidently regarded as unsatisfactory, and it was decided to enlarge the original plan of the portico to its present dimensions in order to improve the general effect. The evidence goes to prove that Mr. Butterfield's proposal was considered and rejected before the church was built."

We hope here be truths.

THE fears that have been expressed that the Government would abandon the Railway and Canal Traffic Bill have been realised, the measure having been withdrawn on Monday. The regret expressed by the Leader of the House of Commons, in announcing that the Government found themselves obliged to take this course, will be echoed by all who are desirous of seeing the railway rates controversy settled, as it was admitted that the Bill went a long way towards putting at rest some of the questions involved. Although it is a severe disappointment, to the agricultural interest in particular, to find the preferential-rate question still in abeyance, there are other points of great interest to both the trading community and the railways also again shelved indefinitely, which is equally disappointing and greatly to be deplored. With regard to the results achieved by the present attempt to legislate upon this subject, the various clauses have been fully considered and commented upon by different bodies interested; and although the anticipated debate in the House of Commons has not taken place, the views of those chiefly concerned have been prominently before the country, and amendments were forthcoming had the second reading been moved, which would, if accepted, have effected some of the reforms admittedly necessary. This will not have been altogether labour in vain, as, of course, the matter cannot now be lost sight of. Outside circumstances have prevented successive Governments from bringing the question to an issue, although it is clearly ripe for settlement; and, while refraining from comment upon the cause of these failures, we sincerely hope that the next attempt may be more successful.

A PAPER, in the June number of *Harper's Magazine*, by Mdme. Jane Dieulafoy gives the fullest popular account yet attainable of the excavations carried on at Susa by that remarkable lady and her husband. It may not be so generally known that in the *Gazette Archéologique* an article by M. Auguste Choisy deals with the subject from a somewhat more technical point of view, without being at all unreadable to the general public. This article is accompanied by a beautiful chromograph plate, giving in *fac-simile* a portion of the enamelled frieze from the palace of Artaxerxes-Memnon. The ground is pale blue, delicately interspersed with dull green, yellow, and white. The architectural remains discovered have nowise disappointed the sanguine prophecies of M. Viollet-le-Duc, at whose instigation, in great part, the expedition was undertaken. No less than 302 engraved cylinders have been brought back. M. and Mdme. Dieulafoy are still hard at work classifying and setting up their *trouvaille*. They told us they hoped the whole would be on view in the Louvre early next year.

A VERY interesting archaic bronze statue is published for the first time in the *Mittheilungen* of the German Archæological Institute ("Romische," Abtheilung II., 2, 2). The statue has been, so to speak, rediscovered; it was dug up long ago in Bartoli's days, and passed into the Barberini Palace. Archæologists paid it little or no attention till it was brought to light in the Exhibition of Bronzes held last year in Rome,—another instance, if one were needed, of the usefulness of these special exhibitions. It belongs now to the Prince Sciarra, who, with the utmost liberality, has allowed it to be examined and published. It was important that this should be done, as the Sciarra palace (in the Corso) is not open to the public. Dr. Studnicska accompanies the plate with a detailed commentary. The statue is, in his opinion, of the first importance in the history of Greek sculptures. It represents a victorious athlete, a boy probably of Peloponnesian birth, for the statue is Sicyonian in style. It dates about the time of the Persian war. The *pose* is very like the well-known Stephanos statue of the Villa Albani.

IT is certainly very much to be regretted that the Government did not sanction the publication of full reports of the Colonial Conference during its sittings instead of publishing verbatim reports in two enormous Blue Books, issued late in the month of July. Indeed, Sir H. Holland's report of the proceedings is only dated July 23rd. The subjects discussed are of the highest importance to business men as well as to politicians, being, among others, postal and telegraphic communications, merchandise marks and Imperial customs tariff, and uniformity of patent marks. To publish the doings of the Conference and the papers read, in two volumes, one costing 6s. and the other 3s. 6d., when the attention of the public has passed away, is one of the most absurd and short-sighted performances which even a Government department could accomplish. At any rate, it is not yet too late to make amends for this stupid management by re-publishing the most salient points and papers in a cheap form.

SIGNOR GIACOMO BONI, in a recent contribution to the *Riforma*, enters another energetic protest, this time against the disfigurement of the noblest buildings in Venice by sign-boards and advertisements,—a practice which has now reached a painful pitch, and calls loudly for repression. He reminds the Venetians that among the sumptuary laws of the Venetian Republic there was one forbidding the occupation of the palaces bordering the Grand Canal to those who made a traffic of their beauty, and it is noteworthy that this law was made at a time that Paul Veronese was immortalising these very persons on canvas, and Peter Aretino was chronicling their lightest actions. Nowadays, the palaces on the Grand Canal are being converted into hotels and *bric-à-brac* shops, or stores for the products of every conceivable branch of industry. "The Venetian Republic," says our enthusiastic Venetian, "excluded from the palaces on the Grand Canal those who bartered their persons for gain, and this was done, not in opposition to personal liberty, but from respect for the locality and its memories. The sale of oneself is less vile than speculating on the beauty of others, and the most infamous of trades is that which tends to destroy the honour of our common mother of that strip of land upon which we were born, whose sons have made it honoured and renowned by deeds which are attested by the fair and stately monuments which have been handed down to us for their preservation, and not that we should pull them down, scrape, or whitewash them, or plaster them over with advertisements or signboards. . . . . Let it be absolutely forbidden to conceal or disfigure the architecture of our palaces (ours as Venetians, although they may be private property) by announcements that within these palaces are for sale the spoils of our one great and redoubtable and still lovely and venerable city."

THE case of *in re* the Oxford Benefit Building and Investment Society, which is published in the current number of the *Law Reports*, is profitable reading for directors in any company as well as for shareholders in building societies. One of the articles of association of the company has that "no dividend shall be payable except out of the realised profits arising from the business of the company." As a matter of fact, however, the directors paid dividends out of profits which were estimated by the secretary to be available. That is to say, the dividends came partly out of floating capital in the hands of the directors, and upon the assumption that the mortgage securities they had taken were sufficient to repay the loans they had taken with interest and costs. In many cases this was not the case, for by their own operation the company depreciated their own securities. Said the Judge, "It might easily have been anticipated that a company like this, having the command of large sums of money, which they were eager to lend for the purpose of encouraging building in the city of Oxford, would stimulate that branch of industry to such an extent as greatly to depreciate building property, and this was what actually occurred." The result was that the directors

were ordered to repay out of their own pockets the sums improperly paid as dividends, also the remuneration they had received, and interest at the rate of four per cent., the amount in which they were mulcted being 21,000*l*. This case, therefore, will serve as a necessary warning to directors to be careful how they pay dividends and estimate profits, and it also makes clear the danger which building societies run of depreciating their securities by unduly encouraging building enterprises.

THE Municipal Council of Paris, before separating for the year, has decided upon creating a new professional school for training apprentices in all the industries connected with book-producing, from paper-making and type-founding to binding and gilding, without neglecting the various methods of producing illustrations. This school will be housed, with the least possible delay, in a building to be erected upon a public site in the Boulevard d'Italie and the Rue de Gentilly, which will accommodate 300 students. The Municipal Council, with the approval of the Administration, has given the commission for the building to M. Charles Lucas.

ONE of the most striking and beautiful of the vases in the British Museum has just received a new and very interesting interpretation. The vase represents a Sphinx, painted in creamy white and finely modelled, carrying on her back a rhyton decorated with a very delicately-drawn red figured design. This design consists of six figures, which fall into groups of two each. The centre and most important group has the figure of a bearded man ending in a coiled tail. This figure has always been called a Triton, and hence the true interpretation has for fifteen years (the vase was found in 1872, and acquired by the Museum in 1873) been missed. Mr. Murray, now Keeper of Antiquities, is the new interpreter. From the simple observation that the tail is that of a serpent, not a fish, he saw that the bearded man was no Triton, but a far more important personage, old Cecrops, the serpent king, founder of Athens. The scene represented is, in fact, the birth of Erichthonios, a myth not uncommon on vases, but special interest attaches to the rhyton, because the manner of presentation is quite unique, as will readily be seen by those who are conversant with mythography. Mr. Murray publishes his views in the last number of the *Hellenic Journal*, and his article is accompanied by two coloured plates of the vase.

WE may note that the same number of the *Journal* is distinguished, not only by several articles of somewhat exceptional interest, but also by the addition of two new features, which we have long thought very desirable, and for the addition of which the *Builder* has more than once pleaded. We refer to the archæological news and the reviews of books. The archæological news of the present number consists of a Report by Mr. Penrose (Director of the British School at Athens), on "Excavations in Greece," most of the news in which we have already from time to time noted, but which is invaluable as a *résumé*; and a valuable paper by Mr. E. A. Gardner (the Director-elect of the School for the coming year), on recent discoveries in Sculpture and Epigraphy. The addition of such papers of general interest should widely increase the circle of readers of the *Journal*.

"MAKING a pie" is sometimes mentioned when the system of competition tendering is discussed, but it is always with breath a little bated, and the hope that all inconvenient things may be avoided. Contractors generally follow suit, and content themselves with judicious smiles,—capable of various interpretations. The Leyton Local Board, as we learn from the *East London Observer*, held an inquiry recently as to their contracts; and obtained some "startling revelations,"—submitted in writing in admirable detail, and with consummate candour. One contractor for roadmaking stated that he took money from "the man who wanted the job," as a reward for sending in bogus tenders, and the successful competitor's version was very like that of his critic. Once, when good faith was kept, the enterprising contractor, Mr. Jackson, paid 25*l*. to each of the contractors who had obtained the quantities, and as a reward obtained 3,000*l*. for work priced at 1,750*l*. Last June perfidy came to the rescue of the ratepayers, as Mr. Jackson found, to his great surprise, "that the old traitor had received the money, and not acted according to his promises." Mr. Carter had received 15*l*. as his honorarium,—5*l*. more than his fellow pie-makers,—but he actually filled in his tender at 556*l*., instead of 731*l*. 19s. 6d. (!), as requested,—and got the job. The Board happened to hear of a want of amity between the two contractors, and asked them to attend an inquiry and explain. They failed to attend, but they wrote very full explanations indeed. Of course, plenty of contractors play the game fairly,—win a contract at a fair price when they want it, or ask a high price when they are quite busy enough. No one wants a contractor who has more work than his personal energy, people, plant, and capital are fitted for. Apathy, blunders, jaded workpeople, delays, ill-will, and frequently litigation, are the results in such cases. The system of competition-tendering intelligently pursued might go on without any of them. Contractors of honour and character decline to tender when they have their hands quite full,—now and for a fair time ahead,—and then others can have a chance also. Contractors without honour and character will, of course, always do the best they can for themselves alone, and could just as well be dispensed with altogether. The Leyton Board have decided "to exclude both contractors from tendering in future, and to extend the area of their advertising." They had previously put their advertisements in one or two papers circulating in their immediate vicinity. Certainly one way of preventing any one "taking a bit to stand out" is to make the stress of competition genuine. Something might also be done by feeling and showing a steady preference for honest men.

IN reference to a Note in our last issue (page 162) about the address of the Chairman of Council of the Association of Sanitary Inspectors for the north-west of England, Mr. Albert Taylor writes to explain that he is the secretary, not the chairman, of the Association, and that the address was delivered, not by him, but by Mr. T. Styles Ainge, the chairman. We regret the mistake, but secretaries who wish their Societies to be correctly represented in the Press should be clearer in their own communications. We received the address in a MS. copy, a great part of which was barely legible, accompanied by a letter scarcely more legible, and with no indication on the MS. itself of either the author of it or the place where it was read. We have no doubt Mr. Taylor is an "energetic secretary,"—all secretaries are,—but one of the primary duties of a secretary is to furnish information in a clear and unmistakable manner.

LETTER FROM PARIS.

THE recent burning of the Théâtre Lafayette, at Rouen,—which happily occasioned no loss of life,—has again brought up the subject of the Opéra Comique disaster, which had already begun to pass out of mind. One cannot affirm that the innumerable restrictions imposed by the Prefecture of Police are everywhere observed; but as far as concerns the State and Municipal theatres the necessary alterations are proceeding steadily, and electric lighting especially is being everywhere installed.

The pickaxe has demolished all that remained of the Opéra Comique, but it will be long enough before it will rise from its ashes, and it is not known yet where the theatre will transport its Penates; there is talk of the Eden Theatre, others name the Vaudeville or the Châtelet, others the Gaîté. The two last-named belong to the City, which seems little disposed to let either of them to the Government,—though it would be an excellent speculation in a financial sense. In regard to acoustic properties, the Châtelet is the best, and if it were only more central in position, would answer the new purpose admirably. The question must of necessity be quickly settled, and probabilities seem in favour of the Gaîté, which stands opposite the Square des Arts et Métiers, and only a step from the principal Boulevards. This building dates from 1862, and was designed by M. Cusin, and decorated externally with statues by MM. Doublemard and Vital Dubray. The interior is adorned with paintings by M. Jobbé Duval. The house will seat about 2,000.

We spoke doubtfully some months ago as to the success of the Jubilee Railway Exhibition, in which the large railway companies refused to take part. The event has confirmed our opinion, and this unfortunate enterprise has been the occasion of all kinds of scandals. The Municipal Council, which gave away much too lightly to the Exhibition a great part of the Bois de Vincennes, is perturbed about the matter; serious accusations have been made against several of its members, and the law has been invoked to throw light on a speculation which has made many dupes, and for which the questions of railway construction and progress were nothing but an open pretext. One consequence to the Municipality will be the spending of about 200,000 francs to put the Bois de Vincennes in order again.

The financial success of this year's *Salon* has been brilliant. Deducting 38,000 francs for pensions and for the victims of the Opéra Comique disaster, the Société des Artistes Français has cleared 323,000 francs; more by about 12,000 francs than last year. The Palais d'Industrie is now taken possession of by the Union Centrale des Arts Décoratifs. The mention of decorative art reminds us of a new experiment, owing, in the first instance, to the late Minister of Agriculture, M. Develle. Thanks to him, we can now see in the sumptuous hotel in the Rue Varennes, which the architect Brune left unfinished, a collection of designs in silversmiths' work by the most eminent artists of the day, and some of them not unworthy of the best days of the Renaissance. It is from among these that the Government will select the prize which, for ten years from 1888, is to be given for agricultural success. Twenty-three competitors have taken part in the competition, among whose works we may specially mention those of MM. Delaplanche, Falguière, Coutan, and Longepied. The first has symbolised the "Ferme-École," under the guise of a pretty peasant girl reading a book; the second has shown a group of little girls dancing round a cup. MM. Longepied and Coutan, besides a series of beautiful miniature figures, personifying rural occupations, have exhibited two bas-reliefs commissioned by the house of Christofle, "Reaping," and "Vintage." Various artists have also exhibited animals, or groups of animals, treated in a modern spirit. M. Jacquemard's "Attelage des Bœufs" is especially remarkable, and M. Valton's "Porcher" is a statuette full of originality. By the side of these groups, in which the influence of Millet is so obvious, the Classic school is represented in this competition by the pretty group of M. Deloye, "Triptolême apprenant Cérès l'Art de cultiver la Terre."

The national *fête*, as usual, has served as the pretext for conferring some artistic *récompenses*. M. Th. Ribot, and M. Busson, the landscape-painter, have received the cross of an officer of the Legion of Honour. The cross of Chevalier has been conferred on MM. Jean Béraud, Ingalbert, Longepied, and Champigneulle. The only remark we need make on these distinctions is in regard to the parsimony of the Government towards architects, who have also some little claim to official honours of this kind.

Turning from these rewards to artists arrived at maturity, we may note that the younger aspirants have just received judgment in the competition of the École des Beaux Arts. The first prize to be settled was that for medal engraving, the subject being "Jason carrying away the Golden Fleece," and the "Prix de Rome" was awarded to M. Charles F. Vernon, pupil of MM. Cavalier, Aimé Millet, and Tasset. In sculpture, the subject was "Ismene and Antigone, daughters of Œdipus, brought to their father by Theseus." After a long examination, the prize was awarded to M. E. H. Boutry, pupil of M. Cavalier; the second prize to M. Charles Desvergnes, pupil of MM. Chapu and Thomas; and an extra prize to M. Felix Soulès, pupil of MM. Jouffroy and Falguière. The ten bas-reliefs sent in showed very genuine

and serious artistic work. For painting, the subject given was the death of Themistocles, a subject which does not appear to have interested the competitors, judging from the cold and formal character of the work. The "Grand Prix" was gained by M. H. C. Danger, pupil of MM. Gérôme and Aimé Millet, and the second by M. J. A. Marioton, pupil of MM. Maillard and Gérôme, and an extra prize was given to M. L. G. A. Charpentier, pupil of MM. Bouguereau and Tony Robert-Fleury. The architectural competition was not adjudged till Monday last, when the "Grand Prix" was awarded to M. Georges Chedanne, pupil of M. Guadet; and the second prize to M. Henri Eustache, pupil of M. Ginain.

As we anticipated, the Institut has ratified the judgment of the Académie des Beaux Arts in giving the biennial prize of 20,000 francs to M. Mercié, who thus obtains, while in the full success of his career, the greatest artistic reward which is to be had in France. The Institut has awarded to M. Sul-Abadie, author of a very graceful "Idylle" exhibited this year, the Deprez Prize, founded to be awarded to a sculptor of ability of less than thirty-four years of age.

Work has been going on diligently in the Champ de Mars, especially about the foundation work of the Palais des Machines, the difficulty of which has been increased by the nature of the ground, which does not afford a solid foundation at a less depth than 8 mètres. In a few days the metal portion of the construction will be commenced, the contract for which has been taken at 1,100,000 francs. The metallic portion of the Eiffel tower, over which 400 men are employed, is already begun, and one can see, from the opposite bank of the Seine, the four large tubes, rising to the height of 6 mètres, which are to receive the lower arches of the tower. The committee of management is considering the question of the power required to put in motion the machinery which is to do its work before the public as part of the show. It is calculated that 2,500 horse-power will be required, at a cost of 1,180,000 francs. For the Exhibition of 1878 the requirement was 1,960 horse-power, at a cost of 980,000 francs. Whether the Exhibition is to be opened in the evenings and to be lighted with electric light is another question to be considered. This question has been adjourned, however, for the present.

Unfortunately, there is a black spot in regard to the exhibition, the rejection of the Metropolitan Railway Bill by 298 votes to 221,—a decision which has given rise to very acrimonious discussions in the Paris journals, which have bitterly reproached the deputies from the provinces with having shown once more their jealousy of improvements in the capital. This, however, is hardly fair; for the fact is that the Governmental project had not been sufficiently developed. The Chamber having refused the project as a matter of general interest, the Municipal Council will probably take it up as one of local interest; but there is not time to get it completed by 1889.

The Government has been strangely inert about the matter of the Hôtel des Postes to which we have before referred; this great building having been completed for two years, and its practical occupation for working purposes appearing as distant as ever, owing apparently to differences of opinion about the furniture and fittings and mechanical appliances. The "Direction des Bâtiments Civils" is, however, to be congratulated on the measures it has taken in regard to the Palace at Versailles, the state of dilapidation of which had caused much anxiety to all those who are interested in our architectural monuments. The Government has asked the Chamber for a vote of 440,000 francs for the works required, among which the repair of the façade of the Louis XIII. wing will cost more than 100,000. The Minister in his report observes that the Republic owes it to itself not to let the works of the great artists of the seventeenth century go to ruin, and it is satisfactory to find that the high officials of the Republican Government, or some of them at least, are awake to the perception that architecture and art are not matters of political partisanship, and that fine architecture, even when produced under a monarchy, is worth preserving. Certainly, unless something is done without delay, the foreign visitors to the Exhibition who go to see Versailles will see only ruins.

The Ministry may also be congratulated on having taken steps to have a proper catalogue made of the admirable tapestries of the Garde Meuble; when this has been done, it will be possible to distribute these almost priceless and little known treasures on loan among the national museums and public edifices.

There seems hope of the Pantheon decoration being really completed at last, which is matter for congratulation; and we may also mention with satisfaction the appointment of M. Deck, probably the first ceramic artist in France, to the post of director of the Sévres manufactory. M. Deck has created by his talent and energy a "fabrique de faïences" which has a European reputation; moreover, he has invented a turquoise blue which bears his name. No one could be better qualified to restore to the Sévres manufacture its ancient reputation.

At the Louvre the new Salle de la Colonnade has been prepared to receive the Dieulafoy collection, and three new rooms on the first floor are set apart for the enlargement of the marine museum.

The municipal administration is very busy about the decoration of the Hotel de Ville, a committee having been formed of painters, politicians, architects, and critics, to decide on the surfaces to be decorated, and their appropriation either to special artists of reputation or to public competition. The work is directed by the President of the Municipal Council, assisted by M. Bailly, and the secretaries are M. Armand Renand, Inspecteur en Chef des Beaux Arts, and M. R. Brown, Chef du Bureau des Beaux Arts.

The decoration of the abattoirs of La Villette is one of the principal works in course of execution. The principal entrance is to have two groups of animals, with figures in bronze, designed by MM. Albert Lefeuvre and Deslongchamps. A new abattoir is to be constructed in the 15th Arrondissement. M. Moreau, architect of the abattoirs of La Villette, has been charged also with the designs of the new building, which will cost not far from four million francs. We may note also the construction at Fontenay-sous-bois of a new infirmary for aged men, and the completion of the Avenues Niel and MacMahon, abutting on the Arc de l'Étoile.

The City Service des Beaux Arts is busy with the completion of the topographical and archæological plan of Old Paris, commenced in 1849 by the late architect, Berty, and which hitherto only included the region of the Louvre, the Tuileries, the city, and part of the University. M. Albert Lenoir has undertaken the mapping out of the other quartiers and faubourgs down to the fifteenth century. The plan will give the line of the enceinte, and that of the old streets and public buildings. No one can be better prepared for the work than M. Lenoir, who knows the topographical history of Paris intimately, and is competent to enter into all further researches which may be requisite.

Paris has got some new statues. At the commencement of the month, the statue of the chemist Nicolas Le Blanc was erected in the Court of the Conservatoire des Arts et Métiers, opposite that of Denis Papin. A few days later the statue of Père Captier, one of the Dominicans shot in 1871 by the Commune, was erected at the École Albert le Grand, at Arcueil; this statue, in white marble, is the work of the sculptor Bonnassieux. On Saturday last the statue of Paul Broca, by M. Chopin, was unveiled on the Boulevard St. Germain.

Art-criticism has lost two able representatives during the past month; M. René Ménard and M. Charles Clément. The first had been a painter, studying under Drolling, Couture, and Troyon, and subsequently became a writer on art. He is author of a much appreciated "Histoire des Beaux Arts," of "Art en Alsace-Lorraine," and of "Mythologie dans l'Art Ancient et Moderne," and was Secretary to the École des Arts Decoratifs. He died at the age of 60.

M. Charles Clément, who died at the age of 66, was a writer of great ability, who for more than twenty years filled the place of art critic to the *Journal des Debats*. Among his principal works were studies on the genius and works of Michelangelo, Leonardo, Raffaelle, Géricoult, and Decamps, also a remarkable book on "Artistes Anciens et Modernes."

The death is also announced, at the age of fifty-four, of the painter Auguste Perrodin, pupil of Hippolyte Flandrin, whose principal work was the decoration of Notre Dame, under the direction of Viollet-le-Duc. His death is a great loss to decorative art.

We also record with great regret the death of M. Ronchaud, Director of the National Museums, at the age of seventy-one. He belonged to an old and noble family of Franche-Comte, though he did not adopt the title to which he had a right. He was a man of letters, and a distinguished archæologist and lecturer on archæology. One of his great pleasures recently was in seeing the complete success of the Dieulafoy mission in Persia, which he had been largely instrumental in promoting; for it was at his instance that the Government voted the necessary funds for the expedition, as well as the ribbon of the Legion of Honour for Madame Dieulafoy, which M. Ronchaud had asked for on her behalf.

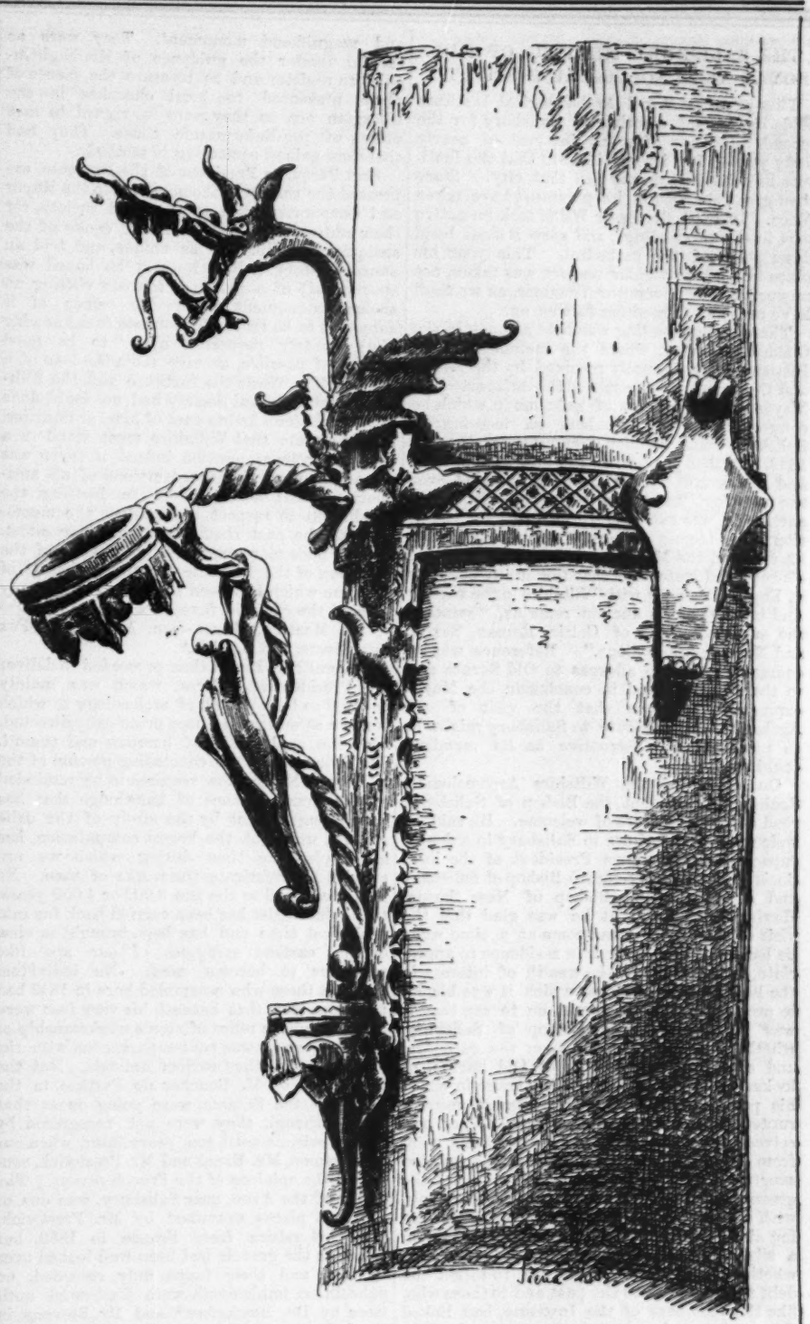
A LOCH LOMOND WATER SUPPLY.

Loch Katrine is famed as a magnificent reservoir, whence the citizens of Glasgow are perennially furnished with an abundant supply of almost pure water; but it is not generally known that Loch Lomond, the greater neighbour of Loch Katrine, and the largest fresh-water expanse of which the island can boast, has also been effectively tapped for purposes of municipal water supply. This is the case, however, and for the past three years, fully, the water of Loch Lomond has served the needs of one water district at least, and served these needs faithfully and well, to the not unwelcome disappointment of a few local critics who early made up their minds that the money expended on the Loch Lomond water-works would be money thrown away. Unlike the case of Loch Katrine, the outlet of whose conduit lies thirty miles away, the customers of Loch Lomond live in the immediate vicinity, though not exactly on the margin of the sheet itself. The loch, with a total area of twenty-eight square miles, is 23 ft. above the level of the sea. From its natural outlet at Balloch, by the River Leven, to the waters of the Clyde at Dumbarton, the distance is four miles on a very easy descent through the Vale of Leven. Originally but sparsely inhabited, the vale has of late years added greatly to its wealth and population, owing to a strong growth on the part of the dyeing industry which the purity of the overflowing loch-water two centuries ago enticed within its bounds. Exclusive of the ancient royal burgh of Dumbarton at the junction of the Leven with the Clyde, the valley has a string of rising townships dotting nearly the whole of its length, these comprising Renton, Alexandria, Bonhill, Jamestown, and Balloch, with a population of over 20,000, where not so long ago the whole ran barely to as many hundreds. Isolated family wells at first supplied the necessary watering; afterwards the springs of the hillside began to be methodically utilised, and less than ten years ago a comprehensive scheme to that end was formulated and carried through by the members and officers of the Local Authority concerned. This strained the capacity of the hillside sources to their utmost stretch, and when it was found that the combined water district of the upper half of the valley still continued growing beyond its equipment, it became manifest that some more liberal and elastic source of supply had to be discovered and organised. Loch Lomond was almost at the doors of the searchers, but the loch did not, till quite late in the quest, suggest itself as a possible solution of the difficulty. Many borings were made over adjacent uplands, and some samples of water, fair to look upon and sweet to the palate, were got, but these the Glasgow analyist, without knowing whence taken, practically condemned one after another. A sample of water from the great loch was also sent,—more, apparently, as a passing curiosity than out of any really serious design, for the loch has a large passenger traffic on its surface now, and many of its conditions would seem to preclude the possibility of a sufficiently high degree of purity. The analyst could tell that this was a pure lake or river water, and on detailed examination he pronounced the sample to be the only unobjectionable one submitted to him, being little, if at all, inferior to Glasgow's Loch Katrine water. A serious objection to the Lomond water still remained in the circumstance that, as many of the streets of the district occupied the flanking ascent of the valley on either side, the loch level was altogether relatively too low for an efficient supply on the gravitation principle. The Water Committee of the Local Authority, with Mr. J. E. Jones, of Dalmonach, at its head, determined, after carefully counting the cost,

to tap the loch by means of pumping. Proprietors on the banks were, for the most part, acquiescent; but some slight objection had, nevertheless, to be met and overcome so as to avoid the expense and delay of a Bill in Parliament. This partial opposition was founded on an apprehension lest continued pumping would drain the water away and appreciably affect the existing levels, to the detriment of all properties fronting the shore. It was shown, however, on the basis of a calculation by the engineer of the scheme, that even on the utterly wild supposition that no water at all came into the loch from the numerous tributaries within its sixty miles of shore circuit and 250 square miles of watershed, or from the heavens above, it would take one thousand days of pumping to reduce the loch level by just one inch, calculating a daily withdrawal by the pumps of four hundred thousand gallons. This was sufficient for the objectors, and the Loch Lomond water scheme at once took material shape, with the result that by the summer of 1883 the water of the loch was fully at the service of all the dwellers within the water area indicated.

The works of the Loch Lomond water-supply commence about 100 yards west of Balloch Pier, at the extreme foot of the lake and contiguous to its outfall by the Leven. About 10 ft. below the surface, so as to get it fresh and cool in the summer, and sufficiently to safeguard against damage from the Loch steamers and other craft at all times, the water is admitted into a 12-in. suction-pipe protected against the ingress of fish, or other undesirable intrusion, by a rose termination of copper, resting on a staging of timber. It flows by gravitation about 100 yards along this pipe to a straining well, 6 ft. 6 in. deep by 5 ft. 2½ in. diameter, sunk into the ground on a concrete foundation at the loch edge, where, after passing through a straining-frame of wove copper wire, it is operated upon by the pumping gear. The pumping-station, however, is situated not on the loch edge, but 700 yards distant from it, on the line of the public road which leads from Balloch down the vale on the western side of the Leven. From the straining well, over this distance of 700 yards, the water is drawn through a 12-in. suction main to the pumping-station, and is thence forced along a supply main, which for a mile and a half follows the public road spoken of, to where it reaches the first houses of Alexandria. At this point, the pipe mounts the hill to the artificial reservoir, situated at a satisfactory altitude, and capable of supplying by gravitation the entire district. The distance from the loch to the reservoir by the pipe line is a little over two miles. It is the function of the pumping-engines, by an average of about ten hours of work daily, to keep this reservoir filled with water freshly taken from Loch Lomond, full storage with partial assistance from the old hill-side spring being sufficient for a twenty days' supply in the event of accident to the waterworks of the loch. The reservoir is supplemented by filters for a further cleansing of the stream before final distribution from the attendant pure-water tank, but on an emergency the water may be sent direct from the loch to the houses without filtration. Half of the district is situated on the opposite or left bank of the Leven, service being performed upon it by a main pipe crossing on the bed of the stream at Bonhill Bridge. The whole was executed from the plans, and under the direction, of Mr. Wilson, C.E., Greenock.

The Vale of Leven supply (exclusive of Renton, which relies on a small hillside loch or tarn of its own) thus constituted on the Loch Lomond basis has continued to give almost full satisfaction to consumers, whether domestic or industrial; and neither prime cost nor current expenditure has exceeded the limits of moderation. The original outlay fell short of 10,000*l.*, and the current annual charges, exclusive of repairs to pipes and plant, are confined to the maintenance of a small but efficient staff of inspectors and works' caretakers. Engineers' reports were lately issued on the capacity of the loch-works supply, in view of a possible extension of the water district boundaries, and from these it appears that with a slight augmentation of strength, and improvement in the pumping machinery, the wants of fully 25,000 of the population might readily be served. At present, about two million gallons of water are taken from the loch weekly, and it is hardly necessary to add that not the slightest discernible impression has been made on the level of the loch itself, or upon the volume of surplus water carried away from it by the Leven.



Link-holder, Siena: Fourteenth Century.

ELECTION OF A DISTRICT SURVEYOR.

At the meeting of the Metropolitan Board of Works on the 29th ult., thirty-five candidates applied for the appointment of District Surveyor for the District of Plumstead and Eltham. In accordance with the order of the Board of the 1st of April, 1887, the members of the Board proceeded to reduce the number of candidates to six, by one ballot, each member being entitled to vote for any six candidates. The result of this first ballot was ascertained by two members of the Board acting as scrutineers, together with a representative of the Clerk of the Board. When the scrutineers delivered their report, the names of seven candidates were returned, in consequence of a "tie" in the voting. The names and numbers of votes so returned were: Batterbury (T.), 35; Bridgman (H.), 13; Hardcastle (W. J.), 11; Pelly (H. A.), 11; Saunders (M. L.), 20; Spiers (W. L.), 18; and Stock (H. W.), 22. A ballot was next taken to decide the tie between Messrs. Hardcastle and Pelly; the result was the retention of Mr. Hardcastle's name. The Board then proceeded to ballot on the remaining six names, with the following results, viz., Batterbury, 23; Bridgman, 0; Hardcastle, 3; Saunders, 7; Spiers, 5; Stock, 3. Mr. Batterbury having thus a clear majority of all votes cast was at once declared to be duly elected, and having thanked the Board for his election, he promised to faithfully discharge the duties of the office.

LINK-HOLDER, SIENA.

This is a good example of spirited design and execution in wrought iron, the best point about it being the ready manner in which a grotesque quasi-animal form is worked out of little more than a mere bar of metal, with forcible expression, though without any attempt at realism.

The Buxton Reservoir.—The Buxton Local Board have accepted the tender of the Arlesey Lime and Portland Cement Company for the supply of 1,000 tons of their "Eddystone Portland Cement" for the construction of the Hogshaw Reservoir.

THE SALISBURY MEETING OF THE ROYAL ARCHÆOLOGICAL INSTITUTE.

This year the Royal Archæological Institute holds its annual meeting in Salisbury for the second time, but after an interval of nearly forty years; for it was in 1849 that the Institute held its first meeting in that city. Since then great changes in its *personnel* have taken place. In 1849 Professor Willis took an active part in the proceedings, and gave a most lucid description of the cathedral. This year his place in that particular respect was taken, not unworthily, by Precentor Venables, as we shall have occasion to mention further on.

The opening meeting was held at noon in the Council Chamber, where the members of the Institute were formally received by the Mayor and Corporation on behalf of the citizens. The Mayor read an address of welcome in which he congratulated the members on meeting in Salisbury under happier circumstances than in 1849. In that year, when the lamented scholar and statesman, Sidney Herbert, presided over the meeting, "the country, and Salisbury in particular, was suffering from a fearful visitation of epidemic cholera." Proceeding with his address, the Mayor quoted and endorsed the oft-repeated statement that few if any counties in England can vie with Wiltshire in the variety and interest of its ancient remains, "evincing the successive ages of Celtic, Roman, Saxon, and Norman occupations." Reference was of course made in the address to Old Sarum and to the cathedral, and in conclusion the Mayor expressed the hope that the visit of the Archæological Institute to Salisbury might be as pleasant and instructive as its members could wish.

On behalf of the Wiltshire Archæological Society, its President, the Bishop of Salisbury, read a second address of welcome. He said he welcomed the Institute to Salisbury in a double capacity,—not only as President of the local Society, but as sixty-eighth Bishop of Salisbury and as sixty-second Bishop of New Sarum. Having remarked that he was glad that the visit of the Institute had come at a time when he had been long enough in residence to appreciate, to some extent, the wealth of interest in the land and the city over which it was his lot to preside, his lordship went on to say that it was impossible for a Bishop of Salisbury, whether he looked down upon the cathedral and city from the heights of Old Sarum, or looked up to the spire from the house in which his predecessors had lived in almost uninterrupted succession since the year 1220, or perceived the still needle-point of that same spire from the plain on which reposed the isolated sanctuary of Stonehenge, or drove along the green wooded valleys in which the little villages, with ancient churches and monasteries clustering along the sparkling streams like jewels upon a silver thread,—it was impossible for him, whether at rest or on a journey, to forget the debt that he owed to the past and to those who, like the members of the Institute, had linked the present and past together and made them a living whole. Passing on, his lordship said that as President of the Wiltshire Archæological and Natural History Society, he had a yet more decided and special reason for welcoming the members of the Institute to Salisbury, for on the occasion of the last meeting of the Institute in the city, in 1849, the veteran John Britton, then about 78 years old, editor and in great part writer of the "Beauties of England and Wales," and of the "Architectural and Cathedral Antiquities of Great Britain," put forth a circular of some importance showing cause why the then Wiltshire Topographical Society should be transformed into a larger and more popular society. The proposal was not taken up at once, but in 1853 the Wiltshire Archæological Society was inaugurated, and the foundation of its library and museum was laid by the purchase of Mr. Britton's collection of books, drawings, &c., which were deposited at Devizes. The Bishop concluded his address by saying that local antiquaries had perhaps, since the first visit of the Institute to Salisbury, learned something more than they then knew as to the true meaning and scope of antiquarian pursuits. They were now less, perhaps, of speculators, and less also of Mediævalists. They went further behind into the roots of things. They examined with as much care (in the person of General Pitt-Rivers) the isolated civilisation of little Romano-British villages as they would a great and magnificent monument. They were as careful (under the guidance of Mr. Nightingale) to register and to treasure the pieces of plate presented to local churches in the Georgian era as they were in regard to rare pieces of pre-Reformation times. They had therefore gained something in method.

Earl Percy, as President of the Institute, expressed the thanks of the members to the Mayor and Corporation, and to the local society, for their addresses of welcome. He spoke of the antiquities of Wiltshire as unique, and told an amusing story (which he said he hoped was apocryphal) of a party of tourists visiting an ancient monument when the owner of it happened to be there; the tourists (not knowing him) politely requested him "to be good enough, if possible, to give them the loan of a hammer!" While the Institute and the Wiltshire Archæological Society had no doubt done much to foster a loving care of local antiquities, he felt certain that Wiltshire must stand in a very exceptional position indeed if there was not ample room for the exertions of all antiquaries, local and general, in inciting the inhabitants to respect and protect the memorials of the past that existed in their midst. Having once more expressed the thanks of the members of the Institute for the addresses of welcome which had been presented, Earl Percy vacated the chair in favour of the "President of the Meeting," Lieut.-Gen. A. H. Lane-Fox Pitt-Rivers, F.R.S., F.S.A.

General Pitt-Rivers then proceeded to deliver the Presidential address, which was mainly devoted to that branch of archæology to which his own attention had been principally directed, viz., the exploration of burrows and tumuli. The following is the concluding portion of the address:—No one now requires to be reminded of the great advance of knowledge that has been brought about by the study of the drift gravels, which, at the lowest computation, has quadrupled the time during which we are enabled to investigate the works of man. No longer confined to the last 3,000 or 4,000 years, the archæologist has been carried back far into geological time and has been brought in view of the earliest struggles of our ape-like ancestors to become men. No individual amongst those who assembled here in 1849 had the least idea that beneath his very feet were to be found the relics of man's workmanship at a time when he was contemporaneous with the elephant, and other extinct animals. But the discoveries of M. Boucher de Perthes, in the valley of the Somme, were going on at that time, although they were not recognised by men of science until ten years later, when our countrymen, Mr. Evans and Mr. Prestwich, confirmed the opinions of the French savant. The valley of the Avon, near Salisbury, was one of the first places examined by Mr. Prestwich, after his return from France in 1859, but although the gravels had been well looked over by him, and their fauna duly recorded, no palæolithic implements were discovered until later by Dr. Blackmore* and Mr. Stevens in the drift beds at Fisherton and elsewhere, where they were found in beds that had been deposited before the valley had worked its way down to the level on which Salisbury now stands. Since then, through the munificence of Mr. W. Blackmore, the Museum which bears his name has made Salisbury a place of reference for information on the antiquities of this period. Similar discoveries were soon made in the valley of the Thames, in which I had the privilege of taking part. Although not the first discoverer of palæolithic implements in the Thames valley, as they had previously been found by Mr. Leech, Mr. Prestwich and Mr. Evans on the seashore near Reculver,† I believe I may claim priority for the part of the river near London. Having carefully watched for the space of a year or more excavations in the drift gravel at Acton, I was able in 1872 to show by means of plans and sections, published in the quarterly journal of the Geological Society, the exact analogy of the palæolithic site there with that of the valley of the Somme, near Amiens and Abbeville. Other similar discoveries have since been made in the valley of the Exe and elsewhere in this country. The nature of the implements found in these gravels was such as to fully bear out the doctrine of evolution, being characterised by extreme simplicity as compared with the stone implements of a later date, and they introduce us to a condition of the arts of man, in which a simple flake or a flint held in the hand at one end and trimmed to a point at the other, appears to have afforded the most advanced idea of a general tool for all the purposes of life, so that the palæolithic or earliest form of implements can be everywhere distinguished by their simplicity from the neolithic or stone implements of a later date, and they are more or less the same in all the localities in which they have been found. As regards the time necessary for the erosion of the valleys and the deposition of the beds belonging to this period, it is generally admitted that it cannot be computed in years. At first, geologists were inclined to demand an enormous time for it, but recently, in consequence of observations on the erosion of glaciers, less time has been thought necessary, and Mr. Prestwich, in a paper read lately before the Geological Society, has given his reasons for believing that the time estimated since the termination of the last glacial epoch may be greatly curtailed. But, although the sequence of palæolithic, neolithic, and bronze implements had been firmly established in the North and West of Europe, it had not been proved that the same sequence took place in Egypt, Assyria, and those countries in which civilisation dates back to a very much earlier time, for it seemed certain that the stone age of the North and West of Europe was contemporaneous with a very much more advanced civilisation in the south and east. The attention of archæologists had therefore been turned for some time to the question of a stone age in Egypt. The valley of the Nile, it was found, was covered with flint implements which correspond in form to those of the palæolithic type of Europe, but this coincidence of form alone, though highly suggestive for the reasons I have given, was not in itself sufficient to determine sequence, because they had been found only on the surface, and in order to prove them anterior to Egyptian civilisation it would be necessary to adduce the same kind of evidence of their antiquity that had been shown in Europe, by finding them in the gravels in the sides of the valley and in places which could be proved to have been undisturbed since Egyptian civilisation commenced, and this was the more necessary because it was known that flints were used for embalming purposes in Egyptian times. Here I may be permitted again to refer to a discovery of my own, although in introducing it into so brief and condensed an account of the history of the subject, I must again claim your indulgence as a lecturer. Being in Egypt in 1881, and having devoted particular attention to this point, I was fortunate enough to find flint flakes and an implement in parts of the gravel of the Nile near Thebes, into which gravel, after it had become nearly as hard as rock by exposure, the Egyptians had cut the square-topped chambers of their tombs, and I chiselled several of these implements out of the gravel beneath stratified seams of sand and loam in the sides of the Egyptian tombs themselves. These flints, I believe, afforded the first absolute evidence of the priority of the use of flint implements to the time of the building of Thebes, and to a time before the valley of the tombs of the kings had been completely eroded. At any rate, it was the first discovery of the kind which had been recorded. I have not been able to go to Egypt since, but I believe that by further search upon that site it may be possible to determine when flint implements were first introduced there, for I could not, after careful search, find them deeper in the gravel than a certain level. If this should prove to be the case, it will be an important additional item of evidence. As regards the osteology of the human skeletons discovered in the drift, our knowledge of them appears to develope slowly. If, as I have said, the skeletons of the Ancient Britons are rare, still less frequent must be those of quaternary man, our knowledge of which must depend on the accidental washing of them into drift deposits or the discovery of them in the floors of caves belonging to that period. For some time it was contended that no approach towards lower forms of life could be recognised in the skeletons of this period, and that the one or two abnormal skulls that had been brought to light were either those of idiots or were the result of disease. But in the presence of additional discoveries of similar skulls and skeletons that have since been made in different parts of the

* Quarterly Journal of the Geological Society, vol. xx., 1864, p. 188.

† Quarterly Journal of the Geological Society, vol. xvii., 1861, p. 362.

world, and more particularly in Belgium, this position can no longer be maintained. Within the last year two additional skeletons have been discovered in the quaternary deposits of a cave at Spy, in the province of Namur, and have been reported upon by M. Fraipont in the *Bulletin de l'Académie Royale des Sciences* in Belgium. The following are reported by M. Fraipont to be the peculiarities in which these skeletons depart from the human form and approach that of the anthropoid apes. The superciliary ridges are more developed and the forehead more shelving than those of any existing race of men, in which respect they resemble the orang, gorilla, and chimpanzee. The chin is more receding than those of any existing race of men. The forward curve of the femur is also greater than any existing race of men, and the angle and size of the articular surface of this bone and the tibia is such as to show that the individuals must have walked with their legs slightly bent. In other respects the skeletons are pronounced strictly human. These appear to be the latest facts revealed to us by the earliest specimens of our race. If they militate against some cherished dogmas we have, nevertheless, no alternative but to accept them if they are established on sufficient evidence. I cannot myself see how human conduct is likely to be affected disadvantageously by recognising the humble origin of mankind. If it teaches us to take less pride in our ancestry, and to place more reliance on ourselves, this cannot fail to serve as an additional incentive to industry and respectability. Nor are our relations with the Supreme Power presented to us in an unfavourable light by this discovery; for if man was created originally in the image of God, it is obvious that the very best of us have greatly degenerated. But if, on the other hand, we recognise that we have sprung from inferior beings, then there is no cause for anxiety on account of the occasional backsliding observable amongst men, and we are encouraged to hope that with the help of Providence, notwithstanding frequent relapses towards the primitive condition of our remote forefathers, we may continue to improve in the long run as we have done hitherto.

On the motion of Earl Percy, the thanks of the meeting were accorded by acclamation to the President for his address.

After an interval for luncheon, the members assembled at the west end of the cathedral, and proceeded to inspect the building, under the guidance of the Rev. Precentor Venables. Passing through the cloisters, they made their way to the chapter-house, where

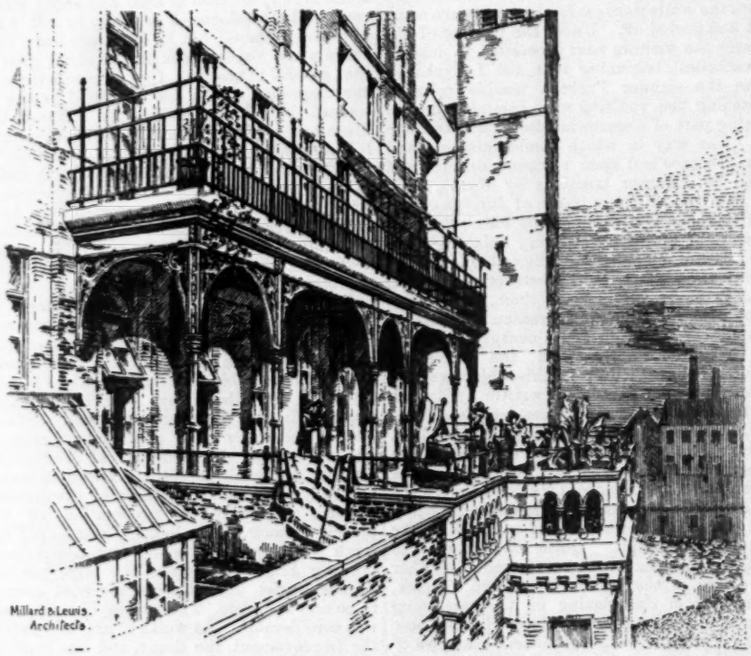
Precentor Venables gave an interesting lecture on the history and architecture of the cathedral. He said that on the former occasion when the Institute visited Salisbury the members had the advantage of being conducted over the building by that master of architectural exposition, especially in connexion with history, Professor Willis, by the kindness of whose nephew and literary executor, Mr. John Willis Clark, of Cambridge, he (the Precentor) was enabled to have the use of the notes and illustrations used in 1849. With their aid, then, he would proceed to sketch the architectural history of that magnificent cathedral,—"magnificent" was not the proper word, perhaps, as it implied a degree of richness and opulence which we did not find in Salisbury. He would rather speak of it as an exquisitely simple and charming building, for it was exceedingly graceful, and perfectly harmonious and symmetrical. Its spire, though not the tallest, was perhaps in point of design the most perfect in the world. As an architectural composition, he regarded Salisbury Cathedral,—more especially as seen from the outside,—as the first of the cathedrals of England. He knew that it was often said, and said with some degree of truth, that Salisbury was one of the least interesting of our cathedrals, but in so far as that was true it was only so because the cathedral (with the exception of the tower and spire) was the continuous development of one design from east to west, carried to completion within a comparatively small number of years. This circumstance was no doubt due to the fact that the foundation of the cathedral on its present site only dated from 1220, the first cathedral of the diocese having been at Old Sarum. Precentor Venables then went on to narrate the story of the transference of the cathedral from the one site to the other, and described the building of the present cathedral, the subsequent addition of the Decorated tower and spire, and the special expedients which had been found necessary to ensure the stability of this part of the cathedral. He of course spoke of the havoc wrought by Wyatt, but pleaded, in extenuation of harsh judgment on his deeds, that in Wyatt's time the idea of the historic value of an old building or an old monument had not dawned: hence the ruin that was effected by well-intentioned custodians of buildings who regarded themselves as perfectly free to make such changes as seemed called for by the necessities, or fancied necessities, of the hour. Having spoken with regret of the pulling down, at the end of the last century, of the detached campanile which stood to the north-west of the cathedral, Precentor Venables devoted a few words to the chapter-house and cloisters. The chapter-house he regarded as in some respects more beautiful than the one at Westminster. The sculptures running all round the building above the arcading were very curious, and would well repay careful study. The present appearance of the chapter-house was in marked contrast to that which it bore when the Institute visited Salisbury in 1849. It was then in a dreadfully dilapidated and neglected condition, and the only thing to regret in connexion with its restoration was that the decorative wall-painting was executed before the walls were perfectly dry: hence much of it had peeled off. Under the conduct of the lecturer the visitors next proceeded to inspect the cathedral, beginning with the Ladychapel, where the slender Purbeck marble columns supporting the vaulting were commented upon as being part of a somewhat daring constructive feat. The way in which tombs, arcades, and other features had been removed, altered, and placed in different positions by Wyatt, as if they had been so many pieces of furniture in a drawing-room, was also pointed out. Much of this work of alteration was very unintelligently done, several monumental effigies being at the present time placed on substructures which certainly never belonged to them. The Precentor also referred to the wanton destruction of much of the thirteenth-century grisaille glass which formerly filled the numerous windows of the cathedral. On this subject we may quote from a little pamphlet,* written by Mr. J. E. Nightingale, who says:—"Considerable and important pieces of this interesting grisaille glass, which originally decorated the windows of the cathedral (with the exception, probably, of the eastern and more important windows, where the richer medallions were used), has been for many years placed in the three lower windows of the south-east transept. Quite lately all the remaining fragments have been brought together by the care of the present Dean and Chapter, and now form the glazing of the remaining windows in this transept. These windows now contain a mine of wealth of ancient examples of thirteenth-century plain glazing, the loss of which is so painfully felt in the present state of the cathedral, and the reproduction of which has not hitherto been successfully attained. The following letter, which was found during the researches of the Historical MS. Commissioners, will show to what extent this reckless destruction of ancient work was carried on during the 'restorations' at the end of the last century. It was written in June, 1788, by John Berry, glazier, of Salisbury, to Mr. Lloyd, of Conduit-street, London:—

'Sir,—This day I have sent you a Box full of old Stained and Painted Glass as you desired me to due wich I hope will sute your Purpos it his the best that I can get at Present. But I expet to Beatt to Peceais a great deale verey sune as it his of now use to we and we Due it for the lead if you want eney more of the same sorts you may have what thear his, if it will pay for taking out, as it is a Deal of Truble to what Beating it to Peceais his you will send me a line as sune as Posobl for we are goain to move ore glasing shop to a Nother Plase and thin we hope to save a greatt Deale more of the like sort which I ham your most Omble Servnt John Berry.'"

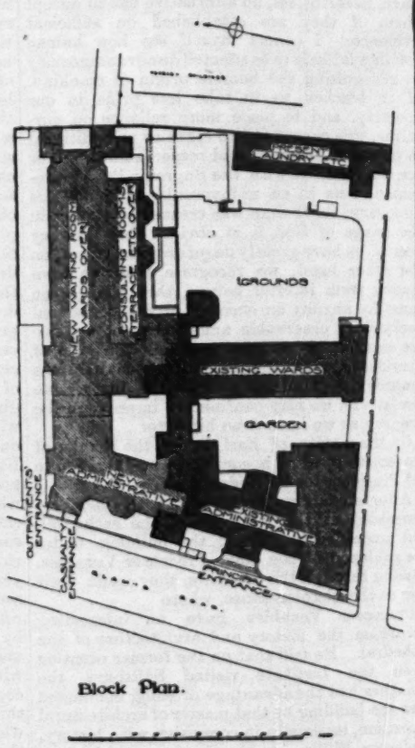
Subsequently a visit was paid to the hospital of St. Nicholas, which shows some considerable remains of Early English work, which were remarked upon by the Rev. Mr. Moberley, the Master. They next proceeded to Harnham Bridge, adjoining, with its chapel, now converted into a dwelling-house. Finally, they visited the Bishop's Palace, under the guidance of the Bishop. Here remarks on the architectural character of the buildings were made by Mr. J. T. Micklethwaite, F.S.A., and Mr. Ponting. To quote from Mr. Nightingale, "The Bishop's Palace has some very ancient portions, but it has been so frequently altered by successive prelates that it is not easy to distinguish which they are. In the cellars were some early arches, in a great measure hidden; these have lately been opened up by the care of the present bishop, and a fine chamber or undercroft of thirteenth-century work has been developed. During the Civil Wars this building was much injured, and the great hall destroyed. It was extensively repaired by Bishop Seth Ward soon after 1668, and it is to this prelate, probably, that a good deal of the existing work must be attributed. Other additions and alterations were made by Bishop Barrington at the end of the last century."

The Antiquarian Section held its opening meeting in the Council Chamber in the evening, when the President of the Section, the Bishop of Salisbury (Dr. Wordsworth), delivered an interesting address on "The Seals of the Bishops of Salisbury." He said that when first he began to have a practical interest in the matter of bishops' seals, some two years ago, he made inquiries whether anything had been written on the subject, and he learnt, somewhat to his surprise, that it was one which was almost wholly untouched. He was shown, indeed, an excellent book on Scottish Seals, in two vols. 4to, by the late Henry Laing, of Edinburgh (published in 1850 and 1866), which contained a catalogue of as many as 223 seals of Scotch bishops; but he could not learn that there was a similar book for England, even of that general character. One or two articles in encyclopædias, and a few scattered papers in learned periodicals, seemed to exhaust the literature of the subject. He was, therefore, led to examine such seals as were accessible in the British Museum and in the Bodleian Library, and formed certain general conclusions which were not difficult to gather, even from such a hurried and partial survey as he then had time to make. He was now glad to find that his friend Mr. W. H. St. John Hope, Secretary of the Society of Antiquaries, had collected a much larger store of information, and drawn much more precise and practical conclusions from the fine series of seals in the possession of the Society last-named, formed, his lordship believed, by the late highly-esteemed Mr. Albert Way. Mr. Hope's paper was read in two divisions on February 3rd and 10th of the present year, and had been recently printed in the "Proceedings" of the Society. To that paper all succeeding inquirers would naturally refer, and it had been of the greatest possible service in the preparation of the present memoir. His lordship said he did not think that Mr. Hope made any comparisons between English seals and the corresponding Scottish series, but otherwise his work seemed to be very complete. The interest of the subject was considerable. As works of art, illustrating the improvement, the decay, and the caprices of public and private taste, they yielded to few of the smaller monuments of the class to which they belonged, and they had the great merit of being subject to strict classification in the order of time, and of forming an almost continuous series, if a sufficient number of examples were examined. Mr. Hope appeared to have had before him 168 examples of pre-Reformation seals. He (the Bishop) had before him thirty-six seals (large and small), belonging to twenty-one individuals out of the thirty-four pre-Reformation bishops of Salisbury; and thirty-three seals belonging to twenty-seven out of the thirty-four post-Reformation bishops,—making a total of sixty-nine seals,—a very considerable number, having regard to all the mischances which were apt to befall such objects, though he did not despair of being able to render the series much more complete. To the theologian the study of seals was of some interest, as showing the types of devotion which were popular in the centuries immediately preceding the Reformation, and the changes of feeling which succeeded it. To the Ritualist (using the term in its proper sense), seals offered certain useful indications of ecclesiastical dress, ornament, and custom, but not, perhaps, as much as might be hoped, owing to the small size of the representations. To the local historian and herald they were naturally of very high value, especially as the arms figured by no means always agreed with those given in the books which dealt with the subject,—*e.g.*, Rev. W. R. Riland Bedford's very useful "Blazon of Episcopacy,"—and in that field they raised many interesting and difficult questions. To the epigraphist the continuous series and development of the lettering ought to be very

* General Notes upon the Places visited during the Meeting. Salisbury: Bennett Bros., *Journal* Office.



TERRACE AND BALCONY.



Block Plan.

East London Hospital for Children.

helpful in determining the epoch of other undated inscriptions. Such being the different studies to which these objects ministered, he had no need to apologise to his audience for the subject he had chosen for his address. He trusted that before the paper was printed *in extenso*, the interest which had lately been aroused in that branch of antiquities would stimulate friends far and near to assist himself and other bishops to complete their sets of seals. He might mention that the Archbishop of Canterbury and the Bishop of Durham had, like himself, called in the aid of the veteran Mr. Robert Ready, of the British Museum, to lay a foundation, and they would be grateful for any help that could be rendered them in filling up gaps in that collection and in the Way collection of the Society of Antiquaries. His lordship then proceeded to deal in detail with the classification of seals of different kinds and periods, and described *seriatim* those belonging to the See of Salisbury. The paper, which was illustrated by impressions of nearly all the seals mentioned, was listened to with great interest, and after a few remarks from the President of the meeting, General Pitt-Rivers, thanks were tendered to the author.

Mr. H. J. Moule, of Dorchester, next read an interesting and learned paper entitled "Description of the Vetus Registrum Sarisberiense, with a Short Notice of some of the other MSS. at Salisbury." In concluding the paper, Mr. Moule paid an eloquent tribute to the writers of these and kindred Mediæval MSS., many of which, he lamented, had been in later times burned or wantonly destroyed.

After a few remarks from Mr. J. T. Micklethwaite, F.S.A., the meeting broke up, and thus terminated the first day's proceedings.

We will continue our report of the Congress in our next.

EAST LONDON HOSPITAL FOR CHILDREN, SHADWELL.

This hospital was built in 1875, since which time its usefulness has been so appreciated that it is now necessary to nearly double the size of the original building. The new wing, which is to be erected as a Jubilee memorial, includes a new out-patients' department, and two wards for twenty-four beds each. The former is the more immediately needed, and will be commenced as soon as the funds allow. It consists of a waiting-room, 129 ft. by 24 ft. 6 in., with dressing and consulting rooms on the south side. Over these will be constructed a terrace and balcony, with access from the ward windows, as shown in the view we publish. A new dispensary is also provided to serve the whole hospital.

The addition to the front block towards the street comprises two isolation rooms and a new casualty room, with a separate entrance from the street. The basement contains boilers for heating the whole of the buildings, engineer's rooms, a new kitchen with the usual offices, dining-hall, store-rooms, &c.

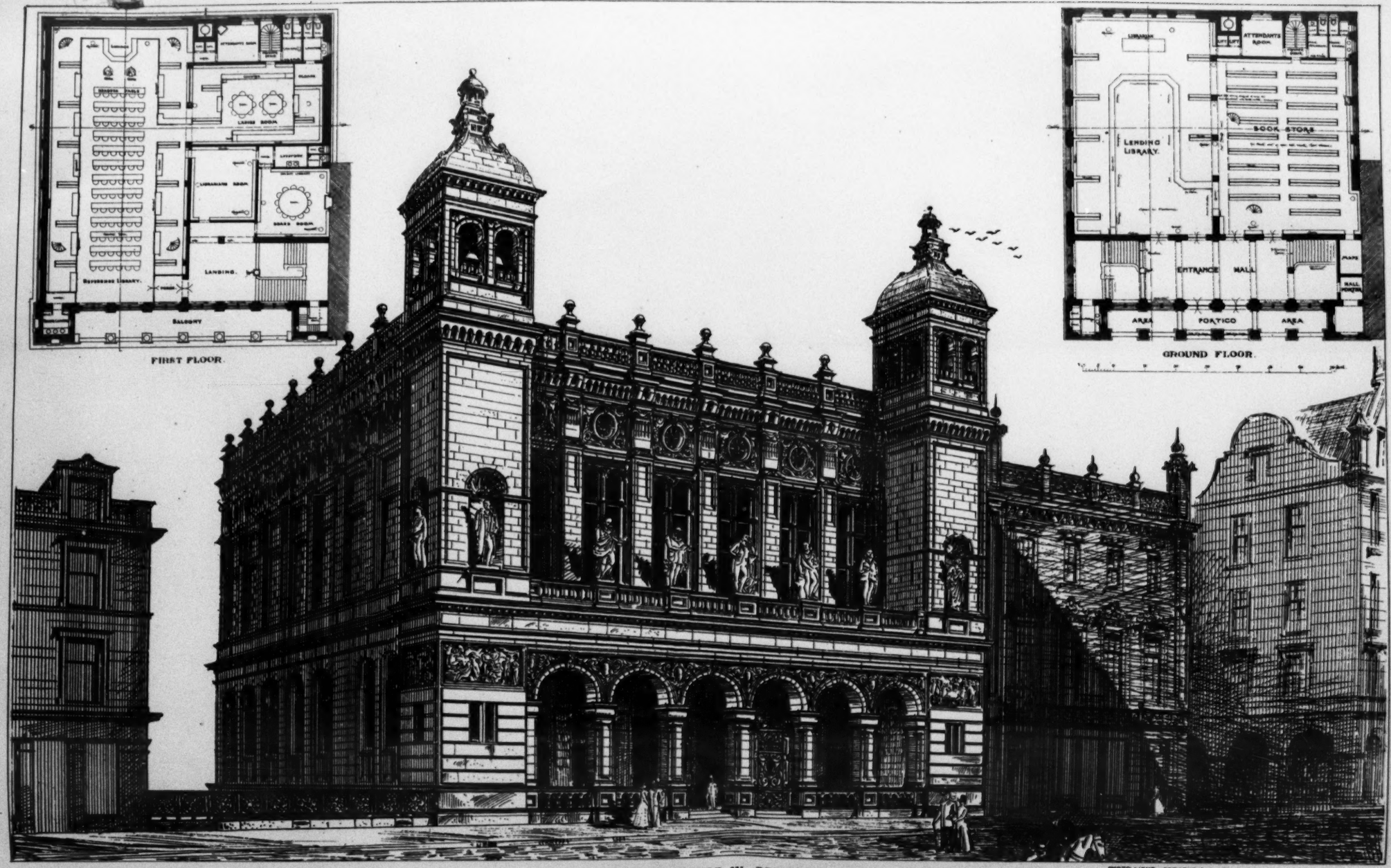
The architects are Messrs. Walter Millard and Wm. G. B. Lewis.

COMPETITIONS.

New Church Tower, Heavitree.—The successful competitor for the Heavitree church tower competition is Mr. E. H. Harbottle, of Exeter. The two next competitors whose designs were considered as of about equal merit, were Messrs. W. & W. B. Barrett-Smith, of London, and Messrs. Packham Croote & Stuart, of Exeter. The committee were advised by Mr. Ewan Christian, late P.R.I.B.A.

The Victoria Hospital for Sick Children, Hull. The design submitted by Mr. Samuel Musgrave, Hull, has been selected; premiums of 15*l.* and 10*l.* respectively being awarded to Messrs. Botteril, Son, & Bilson, and Messrs. Smith & Brodrick, of the same town.

Sheffield.—On Monday last the Mayoress of Sheffield (Lady Stephenson) laid the foundation-stone of new Sunday schools, &c., at Carbrook, of which Mr. C. J. Innocent, of Sheffield, is the architect.



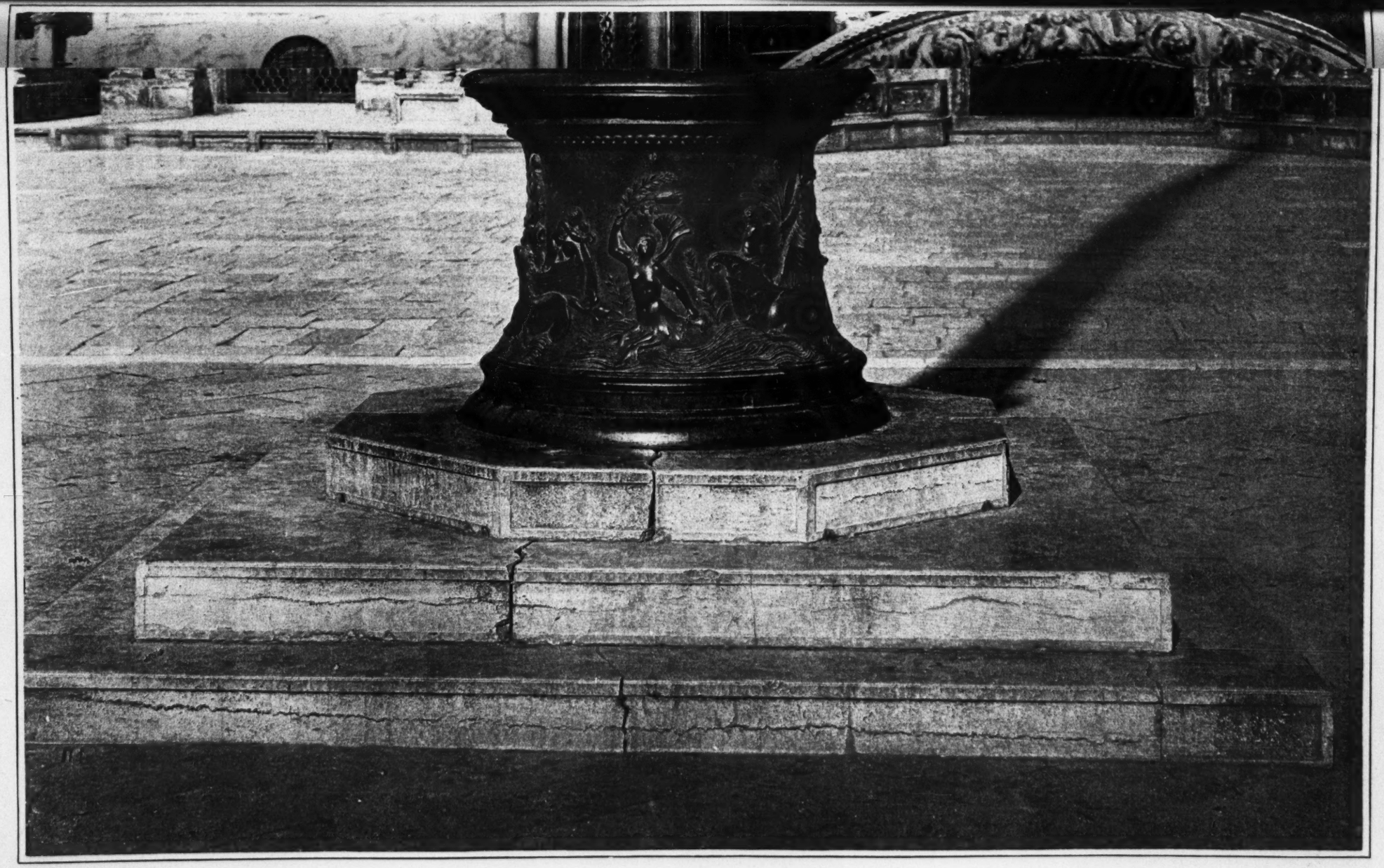
FIRST FLOOR.

GROUND FLOOR.

VIEW FROM GEORGE IV. BRIDGE.

EDINBURGH PUBLIC LIBRARY COMPETITION.

PHOTO-LITHO. SPRAGUE & Co., 82, MARTINS LANE, CANNON ST. LONDON, E.C.



BASE OF FLAG MAST IN THE PIAZZA DI SAN MARCO, VENICE.

PHOTO-LITHO. SPRAGUE & CO., 52, MARTINS LANE, CANNON ST. LONDON, E.C.

VIEW FROM GEORGE IV. BRIDGE.

EDINBURGH PUBLIC LIBRARY COMPETITION.

BASE OF FLAG MAST IN THE PIAZZA DI SAN MARCO, VENICE.

priest of this city and county
to the memory of john roden roper
1838 obit 1838 aetat 73

INK-PHOTO. SPRAGUE & Co 22, MARTINS LANE, CANNON ST. LONDON, E.C.

MEMORIAL TABLET (SIZE 7 ft. 6 in × 3 ft. 9 in.) IN MEMORY OF THE LATE REV. JORDAN ROQUETTE PALMER-PALMER, ERECTED IN BRISTOL CATHEDRAL.

DESIGNED AND EXECUTED BY MESSRS. J. W. SINGER & SONS, FROME, AND 3, DUKE STREET, ADELPHI, W.C.

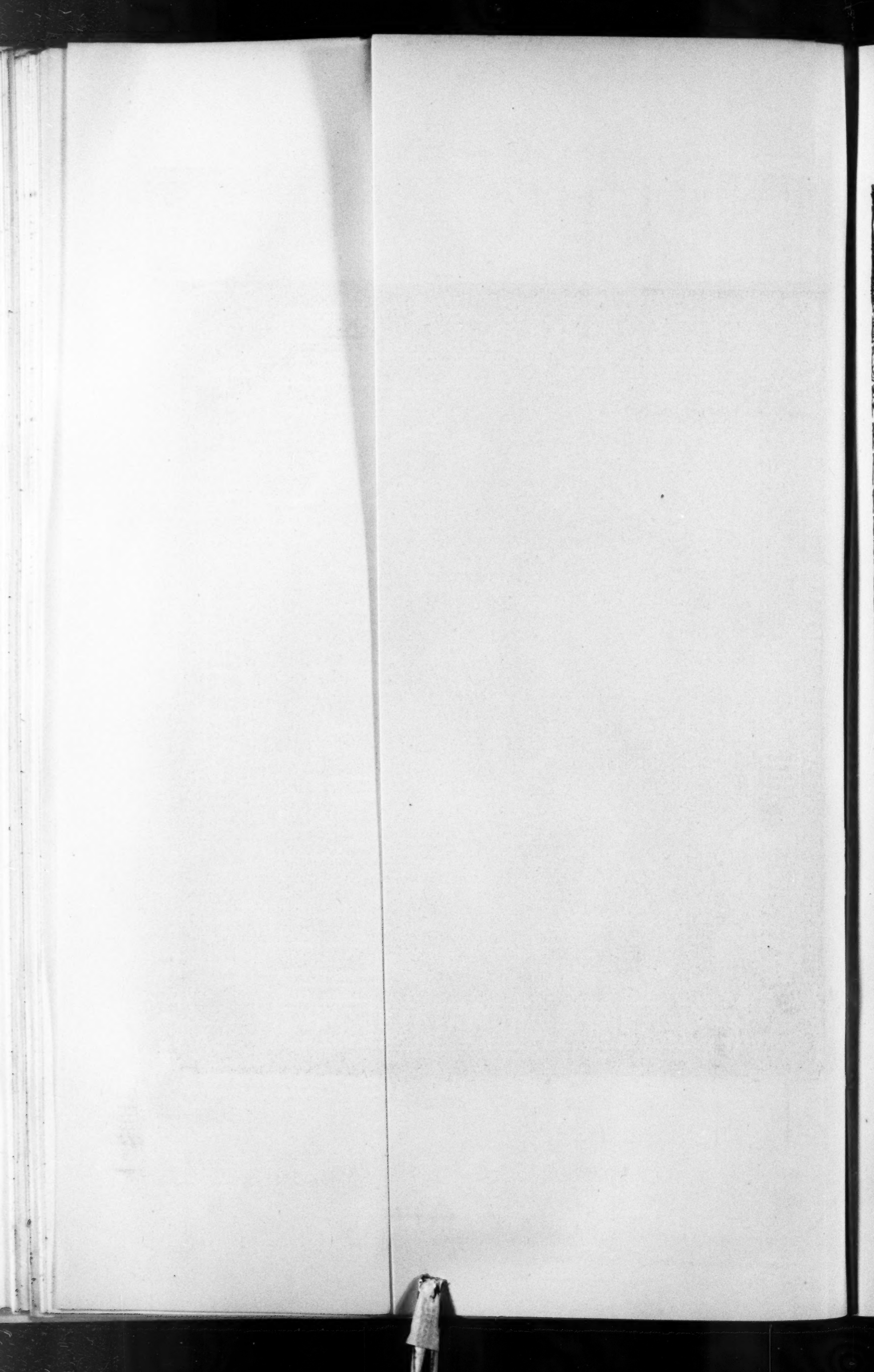
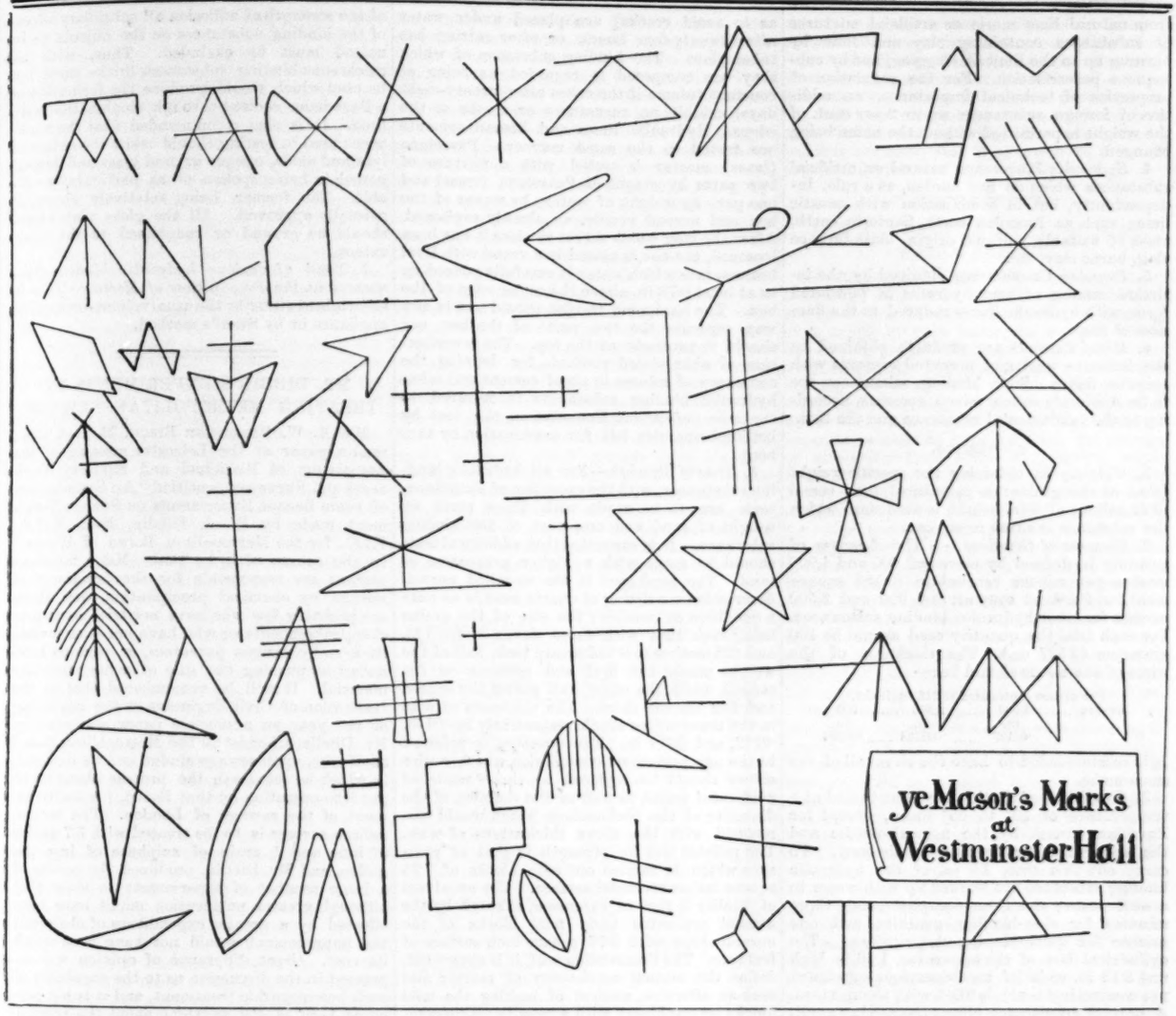


PHOTO-LITHO. SPRAGUE & Cº. 29, MARTINS LANE, CANNON ST. LONDON, E.C.

INTERIOR OF REFERENCE LIBRARY.

EDINBURGH PUBLIC LIBRARY COMPETITION.

DESIGN BY Mr. T. P. MARWICK, A.R.I.B.A.



Illustrations.

BASE OF FLAG-MAST IN THE PIAZZA, VENICE.

THIS is one of the beautiful bronze pedestals in which are stepped the three scarlet masts from which there used proudly to float the gonfalons of silk and gold emblematical of the three dominions of the Venetian Republic, Candia, Cyprus, and the Morea. The pedestals were erected in 1501 and 1505, by Paolo Rabbo, a procurator of St. Mark, and the Doge Loredano, whose portrait it probably is that adorns the medallion on the upper part of the pedestal we illustrate. The elaborately-finished reliefs of sea-nymphs and tritons are the work of Alessandro Leopardi.

MURAL BRASS MEMORIAL TABLET.

THE mural brass, of which we give an illustration, is one of the largest that has lately been engraved in England. It has just been erected in Bristol Cathedral to the memory of the late Rev. Jordan Roquette Palmer-Palmer, and is on the south pier of the tower. The work is incised, the background being sunk and then darkened so as to give effect to the bright foreground. The figures of the Evangelists and the Angels are added on the upper part, to give further effect and support to the principal figure of the priest in vestments. The brass was designed by Mr. E. R. Singer, of the firm of Messrs. J. W. Singer & Sons, by whom the work was executed.

EDINBURGH PUBLIC LIBRARY COMPETITION.

THIS week we illustrate one of the designs selected for special consideration, by Mr. Thomas P. Marwick, A.R.I.B.A. In our issue of June 18 we said "this was one of the best designs exhibited, the plans good, and the architecture characterised by great taste and refinement."

The designer writes that his aim was to secure a library-like building. He has brought the front forward to the line of the bridge, so as to enable the building to be seen from some distance going north or south.

The rooms below the loggia were to be devoted to inferior purposes.

MASONS' MARKS ON WESTMINSTER HALL.

WE are indebted to Mr. T. Shelmerdine for the annexed sheet of mason's marks on the walls of Westminster Hall, as observed and drawn by him. Mr. Shelmerdine says:—

"Nearly all the accompanying marks are on the three first bays at the north-west end of the hall. The marks occur in different positions on the wall, some on the lower course, and similar marks on different courses higher up. If these marks are the work of separate masons, there must have been a great number at work, for this could only represent a small portion employed at the time. Some of the marks seem to represent monograms, others the cross, axe, level, arrows, &c.

I noticed the other day, on some of the remains of Roman London at the Guildhall Museum, similar marks, but cut much deeper, but not on the face of the stone."

Iron Building at Morden. — Messrs. North & Son, of London-road, Southwark, having back a large iron building which had been lent on hire to the National Agricultural Hall Company, Kensington, have erected it on ten acres of freehold land fronting on the Epsom-road, Morden, and recently inaugurated it by placing it at the disposal of the workmen and wives of Messrs. Field & Sons, estate agents, Borough, for their annual outing.

THE TESTING OF HYDRAULIC MORTARS.

ATTENTION has been directed in Germany to the above subject by conferences held in 1884 and 1886 at Munich and Dresden. In compliance with a resolution adopted at the latter assembly, a series of definitions and propositions has, according to the *Thonindustrie Zeitung*, been elaborated in anticipation of the Conference to be held at Berlin during the autumn of 1888, embracing the following leading points:—

A.—GENERAL REMARKS.

Tests should be made in such a manner as shall closely represent the purposes for which the articles will be used. The strength of extension and resistance to pressure of cement mortar, as now usually defined, are not the sole indications of the durability of buildings; resistance to the weather, brittleness, resistance to water, strength of adhesion and constancy of volume being other points of importance.

As the degrees of strength now obtained in mortar are not altogether utilised, it is not required to arrive at higher results. The question whether the mixing of mortar materials shall in future be according to volume instead of weight, is referred to the new permanent Commission.

B.—DESIGNATIONS.

1. *Hydraulic Limes* are products obtained by burning limes containing more or less clay (or silicic acid), which on being moistened with water are slaked wholly or partially into powder. According to local circumstances, they are sold in piece form or hydrated in powder.

2. *Roman Cements* are products obtained from lime marls rich in clay by burning below the limit of slagging. These are not slaked with water, but have to be pulverised by mechanical processes.

3. *Portland Cements* are products obtained

from natural lime marls or artificial mixtures of substances containing clay and lime by burning up to the limit of slagging, and by subsequent pulverisation. For the regulation of properties of technical importance, an addition of foreign substances up to 2 per cent. of the weight is permitted without the name being changed.

4. *Hydraulic Fluxes* are natural or artificial substances which do not harden, as a rule, independently, but in combination with caustic lime; such as Puzzolan earth, Santorin earth, trass of suitable volcanic origin, blast-furnace slag, burnt clay, &c.

5. *Puzzolan Cements* are obtained by the intimate mixing of lime hydrates in powdered form, with hydraulic fluxes reduced to the fineness of dust.

6. *Mixed Cements* are products obtained by the intimate mixing of prepared cements with suitable fluxes. Such binding substances are to be distinctly called mixed cements, according to the fundamental substance and the flux.

C.—TESTING.

1. *Weight.*—In obtaining the specific weight (that of the grains) a cylindrical litre vessel (0·22 gallon) of 4 in. height is used, into which the substance is sifted or shaken.

2. *Fineness of Grinding.* — The fineness of grinding is defined by sieves of 900 and 4,900 meshes per square centimètre (0·155 square inch) for Portland cement, and 900 and 2,500 meshes for other hydraulic binding substances. For each trial the quantity used should be 100 grammes (3·527 oz.). The thickness of the wires of the sieves should be:—

Per square centimètre (0·155 sq. inch).		
Meshes	4,900	2,500 900
	in.	in.
	·00197	·002758 ..... ·00394

It is recommended to have the sieves all of the same make.

3. *Conditions of Setting* are to be tested at a temperature of 59° to 65° Fahr., except for Puzzolan (trass), by the normal needle and the apparatus for defining consistency. To carry out this test, 14 oz. of the hydraulic binding substance are worked up with water to a stiff paste; the time occupied being three minutes for slow-binding qualities and one minute for quick-binding descriptions. The cylindrical box of the apparatus, 1·56 in. high and 3·12 in. wide (of an impervious substance not conducting heat), is filled with the mixture. A normal consistency allows the testing appliance to stop at a height of ·234 in. from the bottom of the box. The normal needle used for testing the setting weighs 10·58 oz., and has a circular sectional surface of ·0015 square inch, the box employed being the same as before. The commencement of hardening has taken place when the needle no longer penetrates the entire substance, and the mixture has set as soon as the needle makes no impression. A similar test can be made with a cake on a glass plate. It is suggested that tests with higher proportions of water than in the normal consistency would be of value. Puzzolana is dried at 212° to 230° Fahr., is subjected to a trial for its loss from heat (defining the proportion of water it contains), and is tested for its initial hardening under water at 59° Fahr. The mixture consists of two parts by weight of Puzzolana (trass), one part of powdered hydrate of lime, and one part of water. The mortar (in the box as previously explained) is placed under water and tested after two, three, four, and five days to find the weight necessary to make the needle penetrate it deeply.

4. *Constancy of Volume.*—Portland cement is tested by being mixed with water to a normal consistence, and made on a thin glass plate into cakes of 3 in. to 4 in. diameter and ½ in. thick. Two of these cakes are, after twenty-four hours, put on a metal plate and subjected to a temperature of 230° to 248° Fahr. for at least an hour, until no more aqueous vapours escape. If the cakes show no curvatures or cracked edges, the binding substance may be considered as being constant in volume. Should the contrary be the case, the result of the test on glass plates is decisive. If more than 3 per cent. anhydrous sulphate of lime be present (or a corresponding quantity of unburned gypsum), this test is not conclusive. The most reliable test consists in stirring 3·52 oz. of cement with water into a normal consistence, a cake of 0·78 in. thickness being formed of the mixture on a glass plate. Two of these cakes (protected from drying so as to avoid cracks) are placed under water after twenty-four hours, or after setting has taken place. The binding substance of which they are composed is regarded as being of constant volume if the cakes after twenty-eight days, exhibit no curvatures or cracks at the edges. Hydraulic limes and Roman cements are tested in the same manner. Puzzolana (trass) mortar is tested with a mixture of two parts by weight of Puzzolana (trass) and one part by weight of water, by means of the box and normal needle, as already explained. After the ring which serves to close it has been loosened, the box is placed in a vessel with level bottom, into which water is carefully poured up to at least 0·78 in. above the upper edge of the box. The hardening mortar should not in any way separate the two parts of the box, nor should it protrude at the top. The investigation of abbreviated methods for defining the constancy of volume in air of cement and other hydraulic binding substances is referred to the new permanent Commission, the test by boiling being also left for examination by that body.

5. *Tests of Strength.*—For all hydraulic binding substances, with the exception of Puzzolana, tests are to be made with three parts by weight of sand and one part of the binding substance. It is suggested that additional tests should be made with a higher proportion of sand. The sand used is the so-called normal description consisting of quartz sand in as pure a condition as possible; the size of the grains being such that with three sieves of 64, 144, and 225 meshes to 0·155 square inch, half of the weight passes the first and remains on the second, while the other half passes the second and lies on the third. The thickness of wire in the three sieves should respectively be ·0156, ·0117, and ·0078 in. The question is referred to the new permanent commission whether wire sieves should be replaced by those made of perforated metal, as well as the defining of the diameter of the perforations which would correspond with the above thicknesses of wire. The reliable test for strength is that of pressure which is carried out with blocks of 7·75 square inches sectional surface. The usual test of quality is that of extension, effected by the normal apparatus upon trial blocks of the normal shape with 0·77 square inch surface of fracture. The Commission will, it is suggested, define the normal consistency of mortar and seek an effective method of making the trial blocks by machinery with a view to uniformity. Meanwhile they are to be made by hand. For ascertaining the strength of extension and the resistance to pressure, six trial blocks are required of each stage of hardening; the average of the four highest results obtained in each case giving the official result. The blocks have to be kept during the first twenty-four hours in air in a room saturated with steam, and for the remainder of the time until the tests under water, at a temperature of 59° to 64° Fahr. The results after twenty-eight days are regarded as decisive. Portland cement mixed in the proportion of 1 to 3 can even be tried after seven days. The testing of strength of Portland cement of normal consistence, made on a non-absorbent foundation, and that of normal sand after three days, are left for the new Commission to deal with. The general question of the testing of hydraulic binding substances in a shorter time than is now customary will also be discussed by that body. The testing of Puzzolana (trass) mortar is effected with a mixture of two parts by weight of Puzzolana, one of powdered hydrate of lime, three of normal sand, and one of water. The test is carried out as previously explained, but in some cases the blocks are placed under water immediately on being made, it being recommended in such cases to add one-tenth more of water in preparing the mortar. The due observance of the prescribed temperature is of importance in these tests, as well as the purity of the lime used; the strength of the composition being greatly dependent upon the last-named ingredient.

6. *Strength of Adhesion.*—It is suggested for the consideration of the new commission that the strength of adhesion of hydraulic binding substances shall be tested by the normal apparatus for testing strength of extension. The testing surface is ·197 in. × ·197 in. = 3·88 square inches. The samples to be tested must be kept in a room saturated with moisture, in the same manner as explained regarding the extension tests. In order to arrive at a right comparison of the strength of adhesion all subsidiary effects of the binding substances on the objects to be united must be excluded. Thus, with all calcareous binding substances bricks must not be used which would produce the formation of a Puzzolana cement through combination with lime. It is also recommended that the appliances used in testing should resist the action of lyes and acids, opaque ground glass and biscuit porcelain being spoken of as particularly suitable. The former, being relatively cheap, is specially approved. All the glass plates used should be ground or roughened to the same extent.

7. *Yield of various hydraulic binding Substances in the Preparation of Mortar.*—This is ascertained either by the usual volume-measuring appliance or by Stahl's method.

MR. DIBDIN'S EXPERIMENTS IN TREATING METROPOLITAN SEWAGE.

Mr. R. W. Peregrine Birch, M. Inst. C.E., read a paper at the Leicester meeting of the Association of Municipal and Sanitary Engineers and Surveyors, entitled "An Examination of some Recent Experiments on Sewage Treatment made by W. J. Dibdin, Esq., F.C.S., F.I.C., for the Metropolitan Board of Works." In the course of it he said,—Many members present are responsible for the treatment of sewage by chemical precipitation, and there are probably few who have not tried numerous chemical reagents, or who have not been invited to do so by various patentees, or persons interested in pushing the sale of some particular material. It will be remembered that at the Institution of Civil Engineers at the beginning of the year, an admirable paper was read by Mr. Dibdin, Chemist to the Metropolitan Board of Works, upon sewage sludge and its disposal, in which he sets forth the process about to be put into operation by that Board, for the treatment of the sewage of London. The metropolitan sewage is to be treated with 3·7 grains of lime and 1 grain of sulphate of iron per gallon, and Mr. Dibdin produced the results of a large number of experiments to show that although greater purification might have been effected by a greater expenditure of chemicals the improvement would not have been worth its cost. Great difference of opinion was expressed in the discussion as to the capability of such homœopathic treatment, and it is not proposed here to say anything about the relative merits of different precipitants; but the 575 analyses made by Mr. Dibdin, besides showing the relative merits of different agents, also show the relative susceptibilities of the samples tested, and it is in order to call attention to the importance of this difference that the author has ventured on this occasion to address the Association of Municipal Engineers and Surveyors. It must be clearly understood that in this communication there is nothing but what could be extracted from Mr. Dibdin's paper; but the object in the two cases not being the same, it has been thought worth while to utilise the large mass of well-authenticated facts obtained by the Metropolitan Board of Works to teach a lesson which on the former occasion was not emphasised as the present author considers it might have been with great advantage. Mr. Dibdin took twenty-three samples of sewage from the Metropolitan Outfall at Crossness, and having extracted from them the matter in suspension, treated each sample in twenty-five different ways. He used lime alone in quantities varying from 3·7 to 15 grains per gallon, sometimes in solution, sometimes as milk of lime. He used lime in conjunction with sulphate of iron in various proportions, lime together with sulphate of alumina, lime supplemented by both sulphates, and also lime, sulphate of iron and animal charcoal together. The chemicals necessary for these treatments were estimated to cost from ·81 of a penny per head per annum to 48s. per head per annum, and it is obvious from Mr. Dibdin's figures that the use of the larger quantity of chemicals would, independently of the expense of dealing with the increased quantity of sludge, have cost a great deal more than their worth. It is to be learned from Mr. Dibdin's figures that whether he added 4·7 grains of chemicals or 108 grains to the gallon at costs respectively of 1½d. per head and 4s. per head, it did not make more than 20 per cent. difference in the amount of organic matter removed. This is very strong, if not conclusive, evidence in support of the opinion

arrived at by the Board of Works, namely, that it was best to limit the amount of chemicals used as proposed by Mr. Dibdin. But although the difference between the effect of one precipitant and another precipitant upon any one of the samples tested is small compared with the cost, the difference in the extent to which two samples have been found to yield the dissolved organic matter contained in them is very striking, and this brings the author to the point he wishes to impress upon the members of this Association having the management of sewage precipitation works, viz., that more is to be expected from experiment and research into the question of what are the influences affecting the susceptibilty of sewage to chemical precipitation than from any number of trials of different chemical agents.

Mr. Birch exhibited a diagram showing the results of one treatment upon twenty-three different samples of sewage, as well as the results obtained from treating one sample in twenty-five different ways.

From the diagram it was apparent that there is a much greater uniformity in the latter set of results than in the former ones, showing that the results arrived at depended more upon some quality or condition of the sewage at the moment of treatment than upon the character or quantity of the precipitant used. The diagram also showed that certain samples have yielded up their impurities far more generously to all of the treatments than other samples have to any, and that certain samples yielded more dissolved organic matter to 15 grains of lime than they did even to a greater quantity of lime together with a considerable addition of sulphate of iron and alumina.

It is obvious, said the author in conclusion, that when certain samples of sewage yield generously to twenty out of twenty-five different treatments, but in the other cases resist reagents which have been effective with other samples of the same sewage, the strength of sewage is not the only factor to be considered, and that the variety of result must be due to some varying physical condition, possibly age or temperature, or degree of decomposition of the sewage when treated, or may be to the temperature of the atmosphere or the barometric or photological conditions prevailing at the time. The author knows that Mr. Dibdin has not at present satisfied himself as to the meaning of the facts collated on the diagram further than was necessary for the question he had in hand at the time he made the experiments; but the author believes that if the science of sewage precipitation is to be advanced it must be through investigations, by gentlemen in this Association, of the nature and extent of the outside influences which affect the action of precipitating agents upon sewage.

In the course of the discussion which followed Mr. Strachan (Chelsea) said that the results of Mr. Dibdin's experiments would only the more strongly incline engineers to cease to put their trust in chemists for the solution of the sewage problem, and Sir Robert Rawlinson strongly condemned the costly expedients which the Metropolitan Board of Works is adopting in order to palliate the evils arising from the discharge of the London sewage into the Thames, expedients which, he predicted, were doomed to fail. Mr. Eacchus, Mr. A. M. Fowler, Mr. McKie, Colonel Jones, and the President, continued a very interesting and practical discussion.

WOOD-DRYING EXPERIMENTS.

The Chicago, Burlington, and Quincy Railroad Company has had carried on at its shops at Aurora some interesting experiments to determine the fluctuations of moisture in various woods during seasoning, the first series of which has just been closed. The chief object of the experiments was to discover the laws of seasoning, if such laws existed, and thus to ascertain in what months the greatest amount of seasoning takes place, and whether wood thus seasoned re-absorbed moisture during the wet months of the autumn and winter. The work, according to the *Railway Review*, from which the particulars given are taken, was undertaken in a systematic manner, the following mode of procedure being adopted. The experiments were commenced on December 21, 1885, and ended on February 28, 1887. Three pieces of rough dressed oak, ash, and Norway pine, thoroughly green, were piled loosely, with cleats between, with a board overtopping them, in a situation where they were protected against drip and direct rain, but where they were open to rain, snow, and the sun on their sides. The conditions were, as nearly as possible, those to which timber piled for out-door seasoning is usually subject. The dimensions of these pieces at the commencement of the experiments were as follows:—Oak,—cross dimensions, 8¾ in. by 5¼ in.; length, 9 ft. 6 in. Ash,—cross dimensions, 8¾ in. by 4½ in.; length, 7 ft. 6 in. Pine,—cross dimensions, 9½ in. by 5¼ in.; length,14 ft. 2 in. In each alternate week, pieces of wood were sawn from these timbers off the same end every time, and borings taken from the centre of the sawn-off blocks. From the oak, 5 in. were sawn off each time for the first eleven tests, and 3 in. for the remaining fourteen tests. From the ash, 4 in. were sawn off for the first eleven tests, and 3 in. for the remaining thirteen tests. From the pine, 5¼ in. were sawn off every time. The borings taken from these pieces were carefully weighed, then thoroughly dried, and again weighed, which process gave the percentage of moisture in each piece. The results of each fortnightly test were tabulated, and show the fluctuations of moisture during the whole period of one year, two months, and one week. The exact percentages of moisture thus obtained are given in the following table:—

Date.	Percentage of Moisture. Oak.	Ash.	Pine.
December 21, 1885	40·93	27·56	24·25
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February 1, 1886	42·36	28·31	23·84
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April 26, 1886	41·23	24·68	21·63
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January 17, 1887			14·10
January 31, 1887			14·61
February 14, 1887			14·35
February 28, 1887			14·61

The above figures indicate that there was a slight increase in all three kinds of wood between January 4 and February 15, 1886. The seasoning,—that is to say, loss of moisture,—began practically February 15, with all three woods, and ended August 2, 1886, with the ash and pine, but in the case of the oak October 11 appears to be the closing time. The results with the oak were not altogether satisfactory to the experimenters. The proposed second series of trials will, it is hoped, throw more light upon this kind of wood. From February 15, 1886, to August 2, 1887, the percentage of moisture in the ash dropped from 29 to 12¼ per cent., a loss of 16¼ per cent. From August 2 to December 20 the fluctuations in the moisture were between 12 and 14 per cent., the exact average being 13·27 per cent. The moisture in the pine from February 15 to August 2 dropped from 24 to 12½ per cent., a loss of 11½ per cent. From August 2, 1886, to February 28, 1887, its fluctuations were between 12½ and 15½ per cent. From October 25 to February 28 the exact extremes of moisture were 14·1 and 14·92 per cent., a difference of only 0·82 per cent. The extreme fortnightly fluctuation was 0·51 per cent. The average fluctuation was 0·3 per cent. The average moisture for that period was exactly 14·5 per cent. These experiments, although they do not at present supply infallible data, in a general way lead to the conclusion that, as regards oak, ash, and pine woods in a green condition, seasoning begins in very early spring (depending, of course, largely upon the kind of weather), and ends in midsummer. The provisional limits of this drying season may be fixed at March 1 and August 1,—in other words, including the months from March to July. It has also been shown that, as regards ash and pine, after seasoning is effected, the wood will not take back water,—that is, not beyond slight amounts during the wet and cold seasons. These conclusions are true, however, only for the interior parts of the woods in question, and of the sizes experimented on. Variation in the character of the wood, condition at the time of cutting down the tree, treatment between that time and the first time of testing, sizes of pieces, and other influences, may alter the conclusions; but it is not likely that they would do this to a material degree.

THE HARWICH AND DOVERCOURT WATER SUPPLY.

According to the *East Anglian Daily Times*, the most important feature in the Jubilee celebration at Harwich was the formal opening of a supply of pure water, the want of which has so long pressed upon the inhabitants of the neighbourhood. Down to the early part of this century the inhabitants of the town and the shipping frequenting the harbour had to depend upon such precarious and at best dubious supplies as could be obtained from the storage of rain-water from house-tops, spring water brought down in wherries or barges from Ipswich or Mistley, and the yield of a few local shallow wells. In 1819 an Act was obtained for the appointment of Commissioners for paving, lighting, and watering the town, with general provisions for such purposes. Boring into the chalk in search of water was resorted to in 1820–2, and in 1826, and again about the year 1840, but in neither case did it appear that water was obtained in any useful quantity that was not absolutely salt. In 1854 Mr. P. Bruff, the engineer for the works under the Commissioners' "Improvement Quays and Pier Act, 1851," as well as for the railway to Harwich, deeming it probable that the difficulty might be overcome by more care and outlay than had previously been resorted to, entered into an agreement (May 16th, 1854), with the Corporation, which was duly confirmed by the Commissioners under the Act of 1819. In consideration of the obligations and conditions thus undertaken, the Corporation granted him the exclusive concession of the water supply for seventy-five years. After various unsuccessful efforts to accomplish what was required and an extension of the limit of time in such agreement, the chalk and underlying strata were pierced to the depth of 1,098 ft., when a hard slaty rock was encountered, and proceedings were then suspended, without obtaining any water whatever. In 1862, the agreement having been revised and extended, Mr. Bruff obtained a supply of water at Dovercourt by means of a well and artesian boring, and commenced supplying the town and borough in 1865–6, and has since continued to do so. Although limited in quantity, and not all that could be desired in quality, having a considerable excess of chlorine in its composition, it proved to be the best obtainable within or anywhere near to the borough, and was thankfully accepted by a large number of the inhabitants as a great improvement upon the former state of things. In 1881, in order to meet the requirements of the Public Health Act, 1875, application was made to the Board of Trade, and a provisional order was conditionally granted, under which efforts were made to effect an improved supply, but were unsuccessful, notwithstanding further large outlay. The order was rescinded, and the agreement between Mr. Bruff and the Corporation reverted to, subject to the conditions imposed by an award made in an arbitration held in accordance with its provisions. Finding that in every case where attempts have been made within the limits of the borough only failure had resulted, it was resolved to carry out a scheme of bringing water of approved quality and in sufficient quantity from the nearest spot where it might be obtainable, and in 1884 and 1886 applications were made to Parliament to authorise works to be established at Bradfield and Mistley, and Acts of Incorporation were obtained by the Tendring Hundred Water Works Company, after considerable opposition, a previous application in 1883 having failed. A site having been acquired at Mistley, a capacious well and boring into the chalk were made, from which the present supply of water is obtained. Buildings have been erected at Mistley, and duplicate engines and pumps fixed, and a main is laid to Harwich, a distance of about twelve miles, and in addition the company have acquired the existing works at Harwich, Dovercourt, and Walton-on-the-

from natural lime marls or artificial mixtures of substances containing clay and lime by burning up to the limit of slagging, and by subsequent pulverisation. For the regulation of properties of technical importance, an addition of foreign substances up to 2 per cent. of the weight is permitted without the name being changed.

4. *Hydraulic Fluxes* are natural or artificial substances which do not harden, as a rule, independently, but in combination with caustic lime; such as Puzzolan earth, Santorin earth, trass of suitable volcanic origin, blast-furnace slag, burnt clay, &c.

5. *Puzzolan Cements* are obtained by the intimate mixing of lime hydrates in powdered form, with hydraulic fluxes reduced to the fineness of dust.

6. *Mixed Cements* are products obtained by the intimate mixing of prepared cements with suitable fluxes. Such binding substances are to be distinctly called mixed cements, according to the fundamental substance and the flux.

C.—TESTING.

1. *Weight.*—In obtaining the specific weight (that of the grains) a cylindrical litre vessel (0·22 gallon) of 4 in. height is used, into which the substance is sifted or shaken.

2. *Fineness of Grinding.* — The fineness of grinding is defined by sieves of 900 and 4,900 meshes per square centimètre (0·155 square inch) for Portland cement, and 900 and 2,500 meshes for other hydraulic binding substances. For each trial the quantity used should be 100 grammes (3·527 oz.). The thickness of the wires of the sieves should be:—

Per square centimètre (0·155 sq. inch).			
Meshes	4,900	2,500	900
	in.	in.	in.
	·00197	·002758	·00394

It is recommended to have the sieves all of the same make.

3. *Conditions of Setting* are to be tested at a temperature of 59° to 65° Fahr., except for Puzzolan (trass), by the normal needle and the apparatus for defining consistency. To carry out this test, 14 oz. of the hydraulic binding substance are worked up with water to a stiff paste; the time occupied being three minutes for slow-binding qualities and one minute for quick-binding descriptions. The cylindrical box of the apparatus, 1·56 in. high and 3·12 in. wide (of an impervious substance not conducting heat), is filled with the mixture. A normal consistency allows the testing appliance to stop at a height of ·234 in. from the bottom of the box. The normal needle used for testing the setting weighs 10·58 oz., and has a circular sectional surface of ·0015 square inch, the box employed being the same as before. The commencement of hardening has taken place when the needle no longer penetrates the entire substance, and the mixture has set as soon as the needle makes no impression. A similar test can be made with a cake on a glass plate. It is suggested that tests with higher proportions of water than in the normal consistency would be of value. Puzzolana is dried at 212° to 230° Fahr., is subjected to a trial for its loss from heat (defining the proportion of water it contains), and is tested for its initial hardening under water at 59° Fahr. The mixture consists of two parts by weight of Puzzolana (trass), one part of powdered hydrate of lime, and one part of water. The mortar (in the box as previously explained) is placed under water and tested after two, three, four, and five days to find the weight necessary to make the needle penetrate it deeply.

4. *Constancy of Volume.*—Portland cement is tested by being mixed with water to a normal consistence, and made on a thin glass plate into cakes of 3 in. to 4 in. diameter and ½ in. thick. Two of these cakes are, after twenty-four hours, put on a metal plate and subjected to a temperature of 230° to 248° Fahr. for at least an hour, until no more aqueous vapours escape. If the cakes show no curvatures or cracked edges, the binding substance may be considered as being constant in volume. Should the contrary be the case, the result of the test on glass plates is decisive. If more than 3 per cent. anhydrous sulphate of lime be present (or a corresponding quantity of unburned gypsum), this test is not conclusive. The most reliable test consists in stirring 3·52 oz. of cement with water into a normal consistence, a cake of 0·78 in. thickness being formed of the mixture on a glass plate. Two of these cakes (protected from drying so as to avoid cracks) are placed under water after twenty-four hours, or after setting has taken place. The binding substance of which they are composed is regarded as being of constant volume if the cakes after twenty-eight days, exhibit no curvatures or cracks at the edges. Hydraulic limes and Roman cements are tested in the same manner. Puzzolana (trass) mortar is tested with a mixture of two parts by weight of Puzzolana (trass) and one part by weight of water, by means of the box and normal needle, as already explained. After the ring which serves to close it has been loosened, the box is placed in a vessel with level bottom, into which water is carefully poured up to at least 0·78 in. above the upper edge of the box. The hardening mortar should not in any way separate the two parts of the box, nor should it protrude at the top. The investigation of abbreviated methods for defining the constancy of volume in air of cement and other hydraulic binding substances is referred to the new permanent Commission, the test by boiling being also left for examination by that body.

5. *Tests of Strength.*—For all hydraulic binding substances, with the exception of Puzzolana, tests are to be made with three parts by weight of sand and one part of the binding substance. It is suggested that additional tests should be made with a higher proportion of sand. The sand used is the so-called normal description consisting of quartz sand in as pure a condition as possible; the size of the grains being such that with three sieves of 64, 144, and 225 meshes to 0·155 square inch, half of the weight passes the first and remains on the second, while the other half passes the second and lies on the third. The thickness of wire in the three sieves should respectively be ·0156, ·0117, and ·0078 in. The question is referred to the new permanent commission whether wire sieves should be replaced by those made of perforated metal, as well as the defining of the diameter of the perforations which would correspond with the above thicknesses of wire. The reliable test for strength is that of pressure which is carried out with blocks of 7·75 square inches sectional surface. The usual test of quality is that of extension, effected by the normal apparatus upon trial blocks of the normal shape with 0·77 square inch surface of fracture. The Commission will, it is suggested, define the normal consistency of mortar and seek an effective method of making the trial blocks by machinery with a view to uniformity. Meanwhile they are to be made by hand. For ascertaining the strength of extension and the resistance to pressure, six trial blocks are required of each stage of hardening; the average of the four highest results obtained in each case giving the official result. The blocks have to be kept during the first twenty-four hours in air in a room saturated with steam, and for the remainder of the time until the tests under water, at a temperature of 59° to 64° Fahr. The results after twenty-eight days are regarded as decisive. Portland cement mixed in the proportion of 1 to 3 can even be tried after seven days. The testing of strength of Portland cement of normal consistence, made on a non-absorbent foundation, and that of normal sand after three days, are left for the new Commission to deal with. The general question of the testing of hydraulic binding substances in a shorter time than is now customary will also be discussed by that body. The testing of Puzzolana (trass) mortar is effected with a mixture of two parts by weight of Puzzolana, one of powdered hydrate of lime, three of normal sand, and one of water. The test is carried out as previously explained, but in some cases the blocks are placed under water immediately on being made, it being recommended in such cases to add one-tenth more of water in preparing the mortar. The due observance of the prescribed temperature is of importance in these tests, as well as the purity of the lime used; the strength of the composition being greatly dependent upon the last-named ingredient.

6. *Strength of Adhesion.*—It is suggested for the consideration of the new commission that the strength of adhesion of hydraulic binding substances shall be tested by the normal apparatus for testing strength of extension. The testing surface is ·197 in. × ·197 in. = 3·88 square inches. The samples to be tested must be kept in a room saturated with moisture, in the same manner as explained regarding the extension tests. In order to arrive at a right comparison of the strength of adhesion all subsidiary effects of the binding substances on the objects to be united must be excluded. Thus, with all calcareous binding substances bricks must not be used which would produce the formation of a Puzzolana cement through combination with lime. It is also recommended that the appliances used in testing should resist the action of lyes and acids, opaque ground glass and biscuit porcelain being spoken of as particularly suitable. The former, being relatively cheap, is specially approved. All the glass plates used should be ground or roughened to the same extent.

7. *Yield of various hydraulic binding Substances in the Preparation of Mortar.*—This is ascertained either by the usual volume-measuring appliance or by Stahl's method.

MR. DIBDIN'S EXPERIMENTS IN TREATING METROPOLITAN SEWAGE.

Mr. R. W. Peregrine Birch, M. Inst. C.E., read a paper at the Leicester meeting of the Association of Municipal and Sanitary Engineers and Surveyors, entitled "An Examination of some Recent Experiments on Sewage Treatment made by W. J. Dibdin, Esq., F.C.S., F.I.C., for the Metropolitan Board of Works." In the course of it he said,—Many members present are responsible for the treatment of sewage by chemical precipitation, and there are probably few who have not tried numerous chemical reagents, or who have not been invited to do so by various patentees, or persons interested in pushing the sale of some particular material. It will be remembered that at the Institution of Civil Engineers at the beginning of the year, an admirable paper was read by Mr. Dibdin, Chemist to the Metropolitan Board of Works, upon sewage sludge and its disposal, in which he sets forth the process about to be put into operation by that Board, for the treatment of the sewage of London. The metropolitan sewage is to be treated with 3·7 grains of lime and 1 grain of sulphate of iron per gallon, and Mr. Dibdin produced the results of a large number of experiments to show that although greater purification might have been effected by a greater expenditure of chemicals the improvement would not have been worth its cost. Great difference of opinion was expressed in the discussion as to the capability of such homœopathic treatment, and it is not proposed here to say anything about the relative merits of different precipitants; but the 575 analyses made by Mr. Dibdin, besides showing the relative merits of different agents, also show the relative susceptibilities of the samples tested, and it is in order to call attention to the importance of this difference that the author has ventured on this occasion to address the Association of Municipal Engineers and Surveyors. It must be clearly understood that in this communication there is nothing but what could be extracted from Mr. Dibdin's paper; but the object in the two cases not being the same, it has been thought worth while to utilise the large mass of well-authenticated facts obtained by the Metropolitan Board of Works to teach a lesson which on the former occasion was not emphasised as the present author considers it might have been with great advantage. Mr. Dibdin took twenty-three samples of sewage from the Metropolitan Outfall at Crossness, and having extracted from them the matter in suspension, treated each sample in twenty-five different ways. He used lime alone in quantities varying from 3·7 to 15 grains per gallon, sometimes in solution, sometimes as milk of lime. He used lime in conjunction with sulphate of iron in various proportions, lime together with sulphate of alumina, lime supplemented by both sulphates, and also lime, sulphate of iron and animal charcoal together. The chemicals necessary for these treatments were estimated to cost from ·81 of a penny per head per annum to 48s. per head per annum, and it is obvious from Mr. Dibdin's figures that the use of the larger quantity of chemicals would, independently of the expense of dealing with the increased quantity of sludge, have cost a great deal more than their worth. It is to be learned from Mr. Dibdin's figures that whether he added 4·7 grains of chemicals or 108 grains to the gallon at costs respectively of 1½d. per head and 4s. per head, it did not make more than 20 per cent. difference in the amount of organic matter removed. This is very strong, if not conclusive, evidence in support of the opinion

arrived at by the Board of Works, namely, that it was best to limit the amount of chemicals used as proposed by Mr. Dibdin. But although the difference between the effect of one precipitant and another precipitant upon any one of the samples tested is small compared with the cost, the difference in the extent to which two samples have been found to yield the dissolved organic matter contained in them is very striking, and this brings the author to the point he wishes to impress upon the members of this Association having the management of sewage precipitation works, viz., that more is to be expected from experiment and research into the question of what are the influences affecting the susceptibilty of sewage to chemical precipitation than from any number of trials of different chemical agents.

Mr. Birch exhibited a diagram showing the results of one treatment upon twenty-three different samples of sewage, as well as the results obtained from treating one sample in twenty-five different ways.

From the diagram it was apparent that there is a much greater uniformity in the latter set of results than in the former ones, showing that the results arrived at depended more upon some quality or condition of the sewage at the moment of treatment than upon the character or quantity of the precipitant used. The diagram also showed that certain samples have yielded up their impurities far more generously to all of the treatments than other samples have to any, and that certain samples yielded more dissolved organic matter to 15 grains of lime than they did even to a greater quantity of lime together with a considerable addition of sulphate of iron and alumina.

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The above figures indicate that there was a slight increase in all three kinds of wood between January 4 and February 15, 1886. The seasoning,—that is to say, loss of moisture,—began practically February 15, with all three woods, and ended August 2, 1886, with the ash and pine, but in the case of the oak October 11 appears to be the closing time. The results with the oak were not altogether satisfactory to the experimenters. The proposed second series of trials will, it is hoped, throw more light upon this kind of wood. From February 15, 1886, to August 2, 1887, the percentage of moisture in the ash dropped from 29 to 12½ per cent., a loss of 16½ per cent. From August 2 to December 20 the fluctuations in the moisture were between 12 and 14 per cent., the exact average being 13·27 per cent. The moisture in the pine from February 15 to August 2 dropped from 24 to 12½ per cent., a loss of 11½ per cent. From August 2, 1886, to February 28, 1887, its fluctuations were between 12½ and 15½ per cent. From October 25 to February 28 the exact extremes of moisture were 14·1 and 14·92 per cent., a difference of only 0·82 per cent. The extreme fortnightly fluctuation was 0·51 per cent. The average fluctuation was 0·3 per cent. The average moisture for that period was exactly 14·5 per cent. These experiments, although they do not at present supply infallible data, in a general way lead to the conclusion that, as regards oak, ash, and pine woods in a green condition, seasoning begins in very early spring (depending, of course, largely upon the kind of weather), and ends in midsummer. The provisional limits of this drying season may be fixed at March 1 and August 1,—in other words, including the months from March to July. It has also been shown that, as regards ash and pine, after seasoning is effected, the wood will not take back water,—that is, not beyond slight amounts during the wet and cold seasons. These conclusions are true, however, only for the interior parts of the woods in question, and of the sizes experimented on. Variation in the character of the wood, condition at the time of cutting down the tree, treatment between that time and the first time of testing, sizes of pieces, and other influences, may alter the conclusions; but it is not likely that they would do this to a material degree.

THE HARWICH AND DOVERCOURT WATER SUPPLY.

According to the *East Anglian Daily Times*, the most important feature in the Jubilee celebration at Harwich was the formal opening of a supply of pure water, the want of which has so long pressed upon the inhabitants of the neighbourhood. Down to the early part of this century the inhabitants of the town and the shipping frequenting the harbour had to depend upon such precarious and at best dubious supplies as could be obtained from the storage of rain-water from house-tops, spring water brought down in wherries or barges from Ipswich or Mistley, and the yield of a few local shallow wells. In 1819 an Act was obtained for the appointment of Commissioners for paving, lighting, and watering the town, with general provisions for such purposes. Boring into the chalk in search of water was resorted to in 1820–2, and in 1826, and again about the year 1840, but in neither case did it appear that water was obtained in any useful quantity that was not absolutely salt. In 1854 Mr. P. Bruff, the engineer for the works under the Commissioners' "Improvement Quays and Pier Act, 1851," as well as for the railway to Harwich, deeming it probable that the difficulty might be overcome by more care and outlay than had previously been resorted to, entered into an agreement (May 16th, 1854), with the Corporation, which was duly confirmed by the Commissioners under the Act of 1819. In consideration of the obligations and conditions thus undertaken, the Corporation granted him the exclusive concession of the water supply for seventy-five years. After various unsuccessful efforts to accomplish what was required and an extension of the limit of time in such agreement, the chalk and underlying strata were pierced to the depth of 1,098 ft., when a hard slaty rock was encountered, and proceedings were then suspended, without obtaining any water whatever. In 1862, the agreement having been revised and extended, Mr. Bruff obtained a supply of water at Dovercourt by means of a well and artesian boring, and commenced supplying the town and borough in 1865–6, and has since continued to do so. Although limited in quantity, and not all that could be desired in quality, having a considerable excess of chlorine in its composition, it proved to be the best obtainable within or anywhere near to the borough, and was thankfully accepted by a large number of the inhabitants as a great improvement upon the former state of things. In 1881, in order to meet the requirements of the Public Health Act, 1875, application was made to the Board of Trade, and a provisional order was conditionally granted, under which efforts were made to effect an improved supply, but were unsuccessful, notwithstanding further large outlay. The order was rescinded, and the agreement between Mr. Bruff and the Corporation reverted to, subject to the conditions imposed by an award made in an arbitration held in accordance with its provisions. Finding that in every case where attempts have been made within the limits of the borough only failure had resulted, it was resolved to carry out a scheme of bringing water of approved quality and in sufficient quantity from the nearest spot where it might be obtainable, and in 1884 and 1886 applications were made to Parliament to authorise works to be established at Bradfield and Mistley, and Acts of Incorporation were obtained by the Tendring Hundred Water Works Company, after considerable opposition, a previous application in 1883 having failed. A site having been acquired at Mistley, a capacious well and boring into the chalk were made, from which the present supply of water is obtained. Buildings have been erected at Mistley, and duplicate engines and pumps fixed, and a main is laid to Harwich, a distance of about twelve miles, and in addition the company have acquired the existing works at Harwich, Dovercourt, and Walton-on-the-

Naze, as well as sites for enlargement of Works and establishment of reservoirs at Bradfield and Dovercourt, and by arrangement with the Great Eastern Railway Company they expect to have a site placed at their disposal for a similar facility at Parkestown, for the use of that locality. On subscription of the further necessary capital it is intended to proceed with the extension of the conduits from the nearest points of junction at Wix Cross to the town and district of Walton-on-the-Naze. After many arduous efforts and large expenditure, extending over a period of more than thirty years, and until recently carried on single-handed by the pioneer of the undertaking (Mr. Bruff), with little encouragement from success of any kind, and sometimes against active opposition, the community of the borough and district are placed in possession of a good and abundant water supply. The wells, borings, and pipe-laying have been carefully and expeditiously carried out by Messrs. Thomas Tilley & Sons, Artesian Well and Hydraulic Engineers, of Walbrook, London, under the direction of Mr. Peter Bruff, Mem. Inst. C.E. The erection of the buildings at the pumping station at Mistley, including a chimney-shaft 82 ft. in height, was entrusted to Mr. F. B. Capon, of Manningtree; and the engines, boilers, and pumping machinery have been fixed by Mr. A. G. Mumford, of Colchester.

BUILDERS' ACCIDENT INSURANCE (LIMITED).

The sixth ordinary general meeting of the above company was held at the Registered Offices on Friday, the 29th ult., Mr. Stanley G. Bird in the chair. The minutes of the meeting of the 7th of July, 1886, being taken as read, the Secretary, Mr. E. S. Henshaw read the report and balance-sheet for the year ending May 31st, 1887. We subjoin a portion of the report:—

"The Directors, in presenting their sixth annual report, have the pleasure of stating that, notwithstanding the increasing competition, the general slackness of trade, and the efforts made by other insurance companies, whose policies are (as the Directors consider) far less favourable to the insured, to draw away members, there has been during the past year a marked increase in the premium income of the Company.

During the past year notice was given to the Company by policy-holders of four hundred and nine accidents, and among these two were of a serious nature, involving injuries in the one case to five, and in the other to eleven men, but although this number greatly exceeded the number of which notice was given during the previous year, the amount paid in claims is somewhat less, and the financial condition of the Company, as will be seen from the accompanying accounts, is very satisfactory. . . . . .

The Select Committee upon the Employers' Liability Bills appointed last session made the following amongst other recommendations:—

1. That the employer shall be liable to sub-contractors' men in respect of injuries resulting from defects in ways, works, &c., of the employer, if such defect had not been remedied owing to negligence of the employer or his foreman.

2. That in Section 8 of the Act the words 'person whose sole or principal duty is that of superintending and who is not ordinarily engaged in manual labour' should be repealed.

3. That the Court may allow an action to proceed, though no notice should have been given, if the Court is of opinion that there was reasonable excuse for the want of notice.

4. Extension of the term 'workmen' to tramway servants, &c.

The Government have stated that it is their intention to introduce a Bill during the present session of Parliament presumably to give effect to the recommendations of the Select Committee, and your Directors will carefully watch any such Bill, and take such steps as they may be advised are necessary in the interests of the policy-holders.

Two Bills to extend the provisions of the Employers' Liability Act have already been introduced by independent members during the present session, but your Directors have reason to believe that neither of such Bills will pass into law.

In view of the additional liabilities which may be thrown upon employers of labour, the directors have thought it the more advisable to add to the fund held in reserve rather than to recommend a larger bonus, and believe that in so doing they will have the cordial approval of the policy-holders.

The question of issuing policies under which a workman would be entitled to compensation for injuries received in any accident, although he might have no right to compensation at law for such injuries, was carefully considered by the directors in conjunction with the actuary and solicitors, but after mature consideration the directors did not see their way to adopt any system which would be alike feasible and attractive."

In the course of some remarks on the report, the Chairman said that the Act was every year becoming more known and appreciated by workmen and lawyers, and there was no doubt it had become a very fruitful source of income to the latter. He considered that they settled many cases for which they were not legally liable, he should say that at least fifty per cent. of their cases were settled in this way, cases which they would contest if they could only be sure of their being tried and settled on their merits, but the sympathy of juries generally went with the workmen. He thought, however, that as a rule they settled their cases in a way which not only gave satisfaction to the insurers but impressed the men with the fact that they were not harshly dealt with.

The report and balance-sheet as audited and presented to the meeting were adopted.

Mr. J. Franks and Mr. George Burt, J.P., having retired from the directorate, it was resolved "That the maximum number of directors be reduced from twenty to eighteen, and that Article 50 of the Articles of Association be and is hereby altered accordingly."

The following retiring directors, Messrs. H. H. Bartlett, S. G. Bird, J. Bradney, W. Brown, W. H. Cowlin, and T. F. Rider, were re-elected.

CHURCH-BUILDING NEWS.

Ditchingham (*Norfolk*).—A new organ has been placed in the parish church. It is divided, and one half is placed against each side of the chancel. Handsomely moulded standards separate each lower case into two bays, the priests' door opening through one of the bays on the south side, and the keyboard occupying one of the bays on the north side. Above the standards, and corbelled beyond them, are the upper cases containing the bellows and pipes. These project only 26 in. from the wall; they are arcaded in three bays, carved and crocketted. The design was made to avoid building an organ-chamber. The only sort of chamber for which funds were forthcoming (and which the architect declined to sanction) was a plain lean-to recess. Such recesses are a disfigurement to the exterior of our country churches, whilst two cases inside are better for the tone of the organ, and furnish and enrich the chancel, and the cost of dividing the organ is but little more than that of a recess. Mr. R. Morriss, of Ditchingham, executed the cases in English oak; Mr. Godbold, of Harlestone, the carving; the whole being the design of Mr. Augustus Frere, architect. Dr. Bunnett, of Norwich, undertook to arrange the specification and supervise the mechanical construction of the organ, and the work was entrusted to Messrs. Norman, Bros., of Norwich.

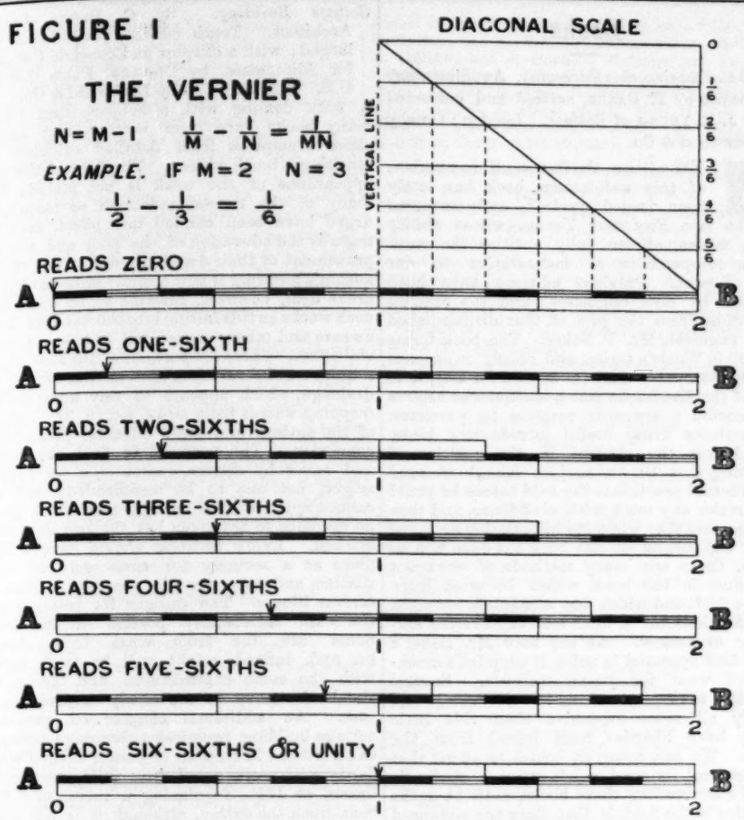
London. — The last of the Bishop of Rochester's ten churches, St. Bartholomew's Church, Camberwell, has lately been consecrated by the Bishop. The church is built in brick, lined with red brick externally, and internally with red brick in the lower portions, and yellow intermixed with a few red bands in the upper portion. The nave piers and other columns are in Dumfries stone. The nave is 40 ft. from floor to wall-plate, and is covered with a lofty roof in pitch-pine, and open to the apex. The chancel roof is curved and divided into panels, which are decorated. The tower, which contains the two vestries (one above the other) is at the east end of the north aisle, and the morning chapel is at the east end of the south aisle. Marble mosaic has been used for the chancel floor and passages, and wood blocks to floors under the seats. The chancel stalls and pulpit are in oak, and the nave and aisle seats are of pitch-pine, and fitted with "Butterfield kneelers." The accommodation is for 700 people, and the cost (exclusive of the upper portion of the tower, not yet built) about 7,500*l*. The whole has been carried out from the designs of Mr. W. Taprell Allen, architect, and executed by Messrs. Stephens, Bastow, & Co., builders, of Bristol and London.

Manchester.—St. Barnabas Church, Pendleton, was consecrated last week by Dr. Moorhouse, Bishop of Manchester. In the construction brick and terra-cotta have been used with stone only where absolutely necessary. The church is of simple detail, but substantial throughout. The contract has been carried out by Messrs. W. Southern & Sons from the designs and under the superintendence of Mr. W. H. Booth, of Manchester. The cost has been under 3,500*l*., and the accommodation provides 516 sittings.

Monkton-Wyld (*Dorset*).—The Church of St. Andrew, Monkton-Wyld, has been enlarged, at the cost of the Rector, the Rev. J. B. M. Camm, by the addition of a sacristy on the north side of the old choir vestry. It has a stone altar, after the example of old English sacristies, and will also have a lavatorium carved in stone, and chests carved in oak to contain the numerous and highly valuable collection of altar frontals, dossals, &c., richly embroidered in silk and beset with jewels. The whole of the structure is in the Early Decorated style, harmonising with the church. The sacristy has been presented to the parish "to commemorate the Jubilee of Queen Victoria, 1887." A new pulpit has just been placed in the church. The base, hexagonal in plan, is of red Mansfield stone, with polished Devonshire marble columns at the angles, from which spring the groined and sculptured Mansfield stone canopy, which supports the superstructure. The pulpit, from the floor over the stone canopy to the top, is in oak, carved and enriched with buttresses, columns, pinnacles, and niches, with boldly projecting crocketed canopies. In the niches stand the figures of four saints sculptured in sycamore wood. The Saints are St. Andrew, the patron of the church; St. Cecilia, crowned with roses bearing the organ and listening in rapture to the songs of the angelic hosts; St. Mary Magdalene, bearing her costly gift of spikenard; and St. Elizabeth of Hungary, with a nun's veil and a crown on her head. A fold of her dress holds a cluster of roses, and a beggar-boy kneels at her feet, to whom St. Elizabeth is in the act of giving bread. The steps to the pulpit are in red Mansfield stone and the balustrading and handrail in polished brass. The pulpit bears an inscription showing that it was erected in memory of Elizabeth Hodson, foundress of the church, at the joint cost of the Rev. Canon Hutchings, M.A., first vicar of this church, and the present Rector. The whole of these works has been executed by Messrs. Luscombe & Son, of Exeter, from the designs of Messrs. Hayward & Son.

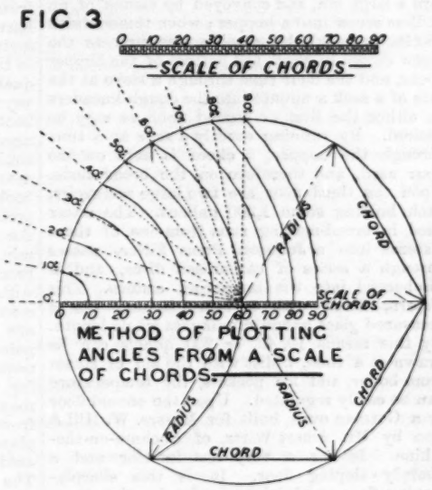
Ringland (*Norfolk*).—The church here, dedicated to St. Peter, was lately re-opened, after considerable restoration works. The whole fabric was in a deplorable state, and the exquisite nave roof was in such danger of falling that it was almost beyond repair. However, with great care every unsound piece of timber has been removed, and the roof is now in a thoroughly efficient state. It is an interesting example of a hammer-beam roof, concealed by groined ribs springing from sixteen columns supported on carved heads, and was erected in the fifteenth century, based upon the design of, and probably built by the same architect as, the roof of St. Peter Mancroft, at Norwich. The north and south aisle and porch roofs have also been renewed in oak, and the whole lead roofing has been relaid. Much repair in the masonry was needed, as trees grew out of the weathering of the buttresses, and the tower was covered with ivy, which seriously weakened it. These were all cut down, the growths removed from under the flint work, and all walls repointed. The stonework of nearly all the windows was renewed. In the north clearstory the original glass, representing the various donors, the angel Gabriel, St. John the Baptist, the Virgin Mary, and many devices and monograms, has been replaced. This part of the work had suffered much from wind and weather and the patching of village glaziers. Messrs. J. & J. King, glaziers, of Norwich, have taken great trouble to carefully refix all this glass. The seats in the nave are renewed in oak, and all the floors are laid in pitch-pine blocks, with tile borders, the monumental slabs being left in their original positions. The entire cost of the works, including pulpit, reading-desk, and chancel seats, will be 2,000*l*., and they have been executed by Mr. Wegg, of Norwich, from designs by Mr. E. Preston Willins, diocesan architect, Norwich.

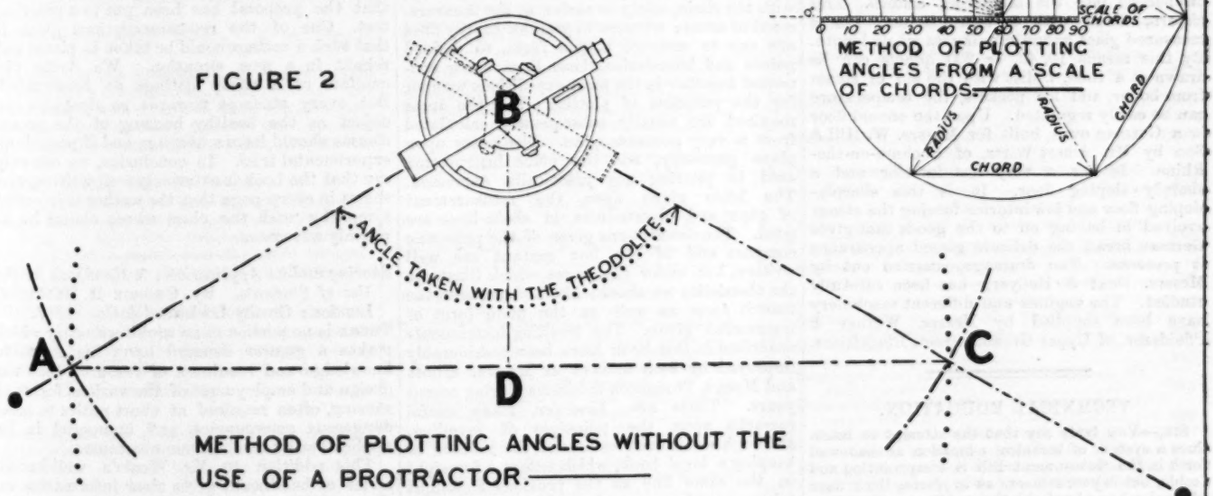
Scholes Church, near Cleckheaton.—In connexion with the Jubilee celebrations a reredos was erected in Scholes Church, near Cleckheaton. The structure is of oak, consisting of three panels, filled in with emblems painted on zinc on a gold ground. A brass lectern was also placed in the church at the same time. Both these works were executed by Messrs. Jones & Willis.



is furnished by the number of the subdivisions which appears to coincide with a division upon the primary scale. Thus when the zero point indicated by the arrow upon the vernier has travelled towards B, a distance of one-sixth of a main division from A, the coincidence appears at the first division from the arrow. For a reading of two-sixths the coincidence appears at the second division from the arrow; and for three-sixths or one-half of a main division the arrow itself coincides with the subdivision upon the primary scale. For a reading of four-sixths the coincidence is similar to one-sixth, but as the arrow in travelling from A towards B has passed the first half subdivision from zero, the one-sixth must be added to the one-half, which gives four-sixths; and, in the same way, two-sixths added to one-half gives a total of five-sixths. For further detail explanation of the vernier, we must refer our readers to p. 102, *Builder*, Jan. 8, 1887.

It will be thus seen that the same result is obtained by means of the vernier scale as would be furnished by the plotting of a diagonal scale upon paper, as shown in the diagram.





METHOD OF PLOTTING ANGLES WITHOUT THE USE OF A PROTRACTOR.

$$\frac{AD}{AB} = \text{SIN ABD}$$

$$AD = AB \times \text{SIN } \tfrac{1}{2} ABC$$

$$AC = 2AB \times \text{SIN } \tfrac{1}{2} ABC$$

The Student's Column.

LAND SURVEYING AND LEVELLING.

VI.—BASE LINES (*continued*).

IN the repetition of the angles taken at the intersection of the base lines as indicated in our previous article (*Builder*, July 30th, p. 188), it will in practice be found that both the second and third operations give a result slightly varying from the first angle read. The amount of difference when divided by the number of repetitions should, however, never exceed the value of one sub-division upon the vernier plate, if the first angle has been correctly recorded. The mean of the different results will furnish the true angle to be plotted. The advantage of recording the first reading is that it serves as a check upon the number of degrees and minutes in the final result.

The subdivisions are read by means of a vernier, the general principle of which is illustrated in fig. 1. If the line A B represents the length of two divisions upon a continuous circle, or upon a straight line of any required length, and if, for example, each of these main divisions be subdivided into two equal portions, as shown, a sliding scale of the length of these two subdivisions containing equal divisions amounting to one more in number than the number of subdivisions upon the primary scale, will enable us to read to amounts equal to one-sixth of a main division upon the primary scale. To render the application of this clear, each main division upon the line A B is shown subdivided into six equal parts, and the sliding scale is represented in seven different positions along the line A B. The vernier or sliding scale is read in each case at the *coincidence* of one of its subdivisions, with a division upon the primary scale, and the number of the sixths to be taken

The most accurate way of plotting angles is by the intersection of arcs, having calculated, as shown in figure 2, the length of an hypothenuse to a triangle the sides of which are taken of equal length. For rough purposes the scale of chords found upon the short plain scale which accompanies nearly every box of instruments is sufficient. The application of this scale, as shown in fig. 3, depends upon the fact that the chord which subtends an angle of 60° at the centre of the circle is equal to the radius, so that by describing a circle with a radius equal to the chord of 60° other angles can be set out by intersecting this circle with a chord equal in length to that given upon the scale for the required angle; and drawing the angle at the centre of the circle which subtends that chord. But for important surveys a circular protractor having a primary scale of divisions and verniers similarly divided to the theodolite is usually adopted.

A HYGIENIC BAKERY.

In James-street, Westminster, Messrs. W. Hill & Son have just opened a new bakery, in which hygienic conditions in bread-making appear to be fully observed. The bread is made by machinery, as at their bakery in Alexander-street, Westbourne Park, which we noticed three years ago. The building at Westminster has been designed by Mr. Thomas Verity, architect, and is Renaissance in character. The builders were Messrs. Green & Lee, contractors, of Anton-street Works, Amhurst-road, Hackney. The façade is adorned with four plaques, modelled by Mr. Harry Bates, whose "Socrates teaching in the Agora," exhibited in the Academy in 1884, gained him the Gold Medal, the Travelling Studentship, and the personal congratulations of Sir Frederick Leighton, P.R.A. Mr. Bates has modelled four life-size figures in high relief, emblematical of "Ploughing," "Sowing," "Reaping," and "Milling," with subsidiary figures in each plaque that are full of life and spirit. Entering, the visitor is conducted in a hydraulic lift to the third floor; here is stowage for at least a thousand sacks of flour. The different flours required for daily use are shot into a large bin, and conveyed by means of an endless screw into a hopper; when this contains 280 lb. (a sack), by a self-acting process the screw ceases to work, the bottom of the hopper opens, and the flour runs through a sieve at the rate of a sack a minute into the dough-kneaders on either the first or second floor, as may be desired. By running exactly a sack at a time through the hopper, a check is kept on the flour used, and therefore on the bread made. Upon the third floor are two large reservoirs, each holding some 1,200 gallons. The water used in bread-making runs from one of these cisterns into a Johnson Press Filter, passes through a series of carbonised discs, and is discharged into the tempering cistern. This cistern, fitted with a thermometer, has a measured glass gauge running its whole length. By this means 10, 40, or 200 quarts can be drawn at a time, whilst with the aid of steam from boiler, and ice pockets, the temperature can be easily regulated. Upon the second floor is a German oven, built for Messrs. W. Hill & Son by Mr. Albert Wirtz, of Bochum-on-the-Rhine. It has a very low interior and a sharply-sloping floor. It is this sharply-sloping floor and low interior forcing the steam evolved in baking on to the goods that gives German bread the delicate glazed appearance it presents. The drainage,—carried out by Messrs. Dent & Hellyer,—has been carefully studied. The engines and different machinery have been supplied by Messrs. Werner & Pfleiderer, of Upper Ground-street, Blackfriars.

TECHNICAL EDUCATION.

Sir,—You truly say that the attempt to introduce a system of technical education as shadowed forth in the Government Bill is disappointing and feeble, but in your remarks as to placing the artisan of England on a level with those of Germany, you are at issue with the Report of the Royal Commission on Technical Instruction, which states that the resources of Continental countries for the technical education of workmen outside of the workshop are much more limited than has been supposed to be the case, and the facilities offered for evening instruction in science and technology are inferior to what our own workmen possess. The advantages of the German workman consist in the general diffusion of elementary education, and in his being compelled to attend during his apprenticeship, for a certain number of hours per week, a continuation school, where the studies of the ordinary elementary school are continued. In many industrial centres there are societies for promoting the technical instruction of the workman in the evening. Then there are the excellent building schools, supported by the State, at nominal fees, but these are held in the day, and can only be attended by those workmen who are able to sacrifice their employment for the purpose,—a sacrifice which many make.

Technical.

Kensington Gardens.—We are glad to learn, from Mr. Plunket's answer to a question asked on Tuesday, that Her Majesty has conceded to the Commissioner of Works a portion of Kensington Palace grounds adjoining the Bayswater-road, in order to make a better and more ornamental approach to Kensington-gardens from that point. The brick wall adjoining the road will be removed.

Books.

Land and Engineering Surveying. A rudimentary treatise by T. Baker, revised and corrected by J. R. Young, of Belfast. London: Crosby Lockwood & Co.

A NEW edition, the fourteenth in number, of this well-known book has lately been issued, revised, and corrected by the late Professor Young, whose ability as a mathematician fully entitles the work as a compendium of mensuration to our best respect. Previous editions have been revised by civil engineers, and the original text came from the pen of that distinguished civil engineer, Mr. T. Baker. The book forms No. 60 in Weale's series, and, chiefly on account of its reasonable cost (it is sold for 2s.), it is one of the first books that a student who aspires to become a surveyor resolves to purchase. It contains many useful introductory hints, but leaves the student in the position of realising that he knows just enough to need some actual practice in the field before he could undertake any work with confidence, and then he discovers that, while the information acquired from the perusal of the book has done him no harm, there are many methods of work not included in the book which he must learn in the field, and which are absolutely essential qualifications for a land and engineering surveyor to possess. At the time Mr. Baker's book first appeared in print, it supplied a much-needed want for young students. Several similar works, some more elaborate, and nearly all more expensive than this little book, have likewise been issued from the press. We are, however, bound to admit that the general impression left upon a student's mind after reading these books, until he seeks practice in the field, is that lines are measured with the chain, solely to arrive at the measurement of areas; whereas in practice survey lines are run to measure offsets from, to defined points and boundaries, these lines being connected together in the most expeditious manner for the purposes of plotting; and the areas required are usually subsequently calculated from a very accurate plan. The notes upon plane geometry, and the office instruments used in plotting are practically expressed. The hints given upon the measurement of gaps and obstructions in chain lines are good. The descriptions given of the prismatic compass and of the box sextant are well written, but under the pages which illustrate the theodolite we should like to have seen the transit form as well as the plain form of instrument given. The levelling instruments described in this book have been considerably improved by such makers as Messrs. Elliott and Messrs. Troughton & Simms during recent years. There are, however, many useful remarks upon the principle of levelling, although we cannot commend the method of keeping a level book, which enters a foresight in the same line as the previous backsight taken upon the same point. Thus, upon p. 145, the system would be clearer to the student if all the figures in the backsight column were raised one line, so that the backsight reading 13·71 would come upon the same line as the reduced level, 100·00, to which it refers. The backsight reading 9·40, and the foresight reading 7·88, are both taken at 519 links from the commencement of the section, and therefore would be better booked upon the same line as this distance is booked. We also should have preferred to see a column for intermediate sights to avoid the addition of the readings taken without shifting the instrument when checking the reduction of the levels in the usual way. Thus the reading, 10·96 at the centre of the road, half-way down the page, would here have been entered as an intermediate sight. In taking sections over very rough country, considerable labour in the final reduction of the level book is saved by the introduction of a column for intermediate sights.

The excellent chapters at the end of the book, upon the laying out of railway curves, turnouts, crossings, the setting out the surface widths of railways, tunnelling, and the methods adopted for running contours, are clear and precise, and contain most valuable information for the railway engineer. A comprehensive index is, we are glad to observe, added at the conclusion of the work.

Cottage Building. By C. Bruce Allen, Architect. Tenth edition, revised and enlarged; with a chapter on Economic Cottages for Allotments, by Edward Ellis Allen, C.E. London: Crosby Lockwood & Co.

A book dealing with a subject upon which many books have been written may surely claim exemption from detailed criticism on reaching a tenth edition. The date of the first appearance of the work is not stated; but many of the recommendations so eloquently urged have been carried into effect, both as regards the education of the poor and the improvement of their dwellings, and much of the author's pleading is now happily unnecessary. A great deal, however, remains to be done, and such works as this falling into the hands of landowners and others cannot fail to have a beneficial effect. There are portions of the book which require careful revision, such as the section on drainage, which appears to rely upon *double trapping* wastes from sinks, &c. (p. 27), instead of the modern and more effectual plan of disconnexion. The proposal to flush the drains and eaves by cistern wastes is, if we read it aright, not one to be commended; and we cannot approve of a cottage plan which gives no fireplace to any room but the one used as a kitchen. Every bedroom *should* have a fireplace as a security for some sort of ventilation, and as a possible necessity in case of serious illness. The designs for cottages are the least satisfactory portion of the book. Some are far from what they should be, and, indeed, might well be made better with the same expenditure; and others we should be sorry to see newly erected in any case. An additional chapter on economic cottage building promises a five-room cottage, to be erected in sections or panels of iron standards with corrugated iron filling and wood lining, at 125*l.*, furnishing a return of 6 per cent. upon the outlay, although it is not clear that the proposal has been put to a practical test. One of the recommendations given is that such a cottage could be taken to pieces and rebuilt in a new situation. We doubt the comfort of a cheap cottage so constructed. But every attempt towards so desirable an object as the healthy housing of the poorer classes should have a hearing, and if possible an experimental trial. In conclusion, we can only say that the book is extremely well written, and shows in every page that the author is in entire sympathy with the class whose claims he so warmly advocates.

Shoring and its Application: a Handbook for the Use of Students. By George H. Blagrove. London: Crosby Lockwood & Co. 1887.

There is no portion of an architect's duty which makes a greater demand upon his scientific knowledge and readiness of resource than the design and employment of the various forms of shoring, often required at short notice to meet dangerous emergencies, and hampered in its application by troublesome conditions.

This addition to Mr. Weale's well-known series of handbooks gives clear information on the principles of shoring, which the student will find not only useful but necessary, and descriptions of accomplished works of special importance and difficulty which he cannot but find interesting. The little book might have been advantageously extended and more copiously illustrated, but, so far as it goes, it may be safely recommended to those for whose use it is more particularly designed.

Civil and Mechanical Engineering Popularly and Socially Considered. By J. W. C. Haldane, C.E. and M.E. London and New York: E. F. & N. Spon. 1887.

This is an attempt to write a popular book of engineering gossip somewhat lighter than even its title would imply. It is written in a lively manner, and contains some good stories, also some rather poor ones, and gives a certain amount of popular information as to what goes on in an engineering and ship-building yard (the book deals principally with marine engineering) in a very desultory kind of manner. A popular sketch of engineering work is a quite possible kind of thing to be done, but it is not so easy to do it well, and requires rather more literary grasp and power than the author seems to possess; the book hardly gives information enough for one class of readers nor amusement enough for another class; the volume is a collection of gossip rather than a book; and, like one of

he engineering inventors he describes, the author goes in for too much of the "slap-bash-bang!" style. Those who are thinking of sending any youth into the engine-building profession may, however, pick up some hints out of the book as to the nature of the life and the work he has to look out for, amid a good deal of padding. Among the good stories (we do not affirm that it is new) is that of an old yachting pilot who was taking a yacht through a dangerous channel, and being asked by the owner whether he was sure he knew the place well, replied "I ken every rock on this coast, from Cape Wrath to the Mull of Galloway,—there's one of them," he added, as the ship struck on a sunken reef.

Tourist's Guide to the Wye and its Neighbourhood. By G. Phillipps Bevan, F.S.S. With maps and plan. London: E. Stanford. 1887. This is a conveniently small-sized guide-book, containing good maps, indications as to routes, and a great deal of information in a small space in regard to objects of architectural and archæological interest, better done than is usual in guide-books. A plan of Hereford Cathedral, which is of course the central object of this portion of the work, is appended.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

8,310, Spray Ventilators. J. Jauka.

This invention consists essentially in a U-shaped pipe, one leg of the tube being in communication with the room, the other opening to the outer air. Two sprays are employed, one to introduce fresh air into the room, the other to suck air out of the room to be ventilated. Regulation is effected by means of an appliance for widening or spreading the spray. The force of water and the draught produced is therefore at all times under control; it can be regulated, or entirely shut off, by the button attached.

10,730, Ornamental Fillets. E. A. Brinkmann.

The object of this invention is to cheaply imitate decorative fillets heretofore engraved by hand. Soft wood is covered with a paste of chalk and glue, and, before the paste hardens, patterns are impressed upon it, and the whole is gilt, painted, or otherwise decorated.

10,917, Glazing, &c. D. Brown.

By this invention two bars are combined, each having a single curl, which supports the glass, and also forms a drip-water channel. Sometimes a covering of lead is placed over the whole astragal; this then further fixes the glass, and obviates the use of putty.

10,920, Bolts for Double Doors. F. Henson.

An arrangement of spiral spring and screw allows the bolts at the top of the double doors to be easily fastened and unfastened.

11,086, Portable Buildings. J. C. Gsottbauer.

According to this invention, buildings designed for transport are formed of short and thin boards easily carried so that horses or other draught animals are not required. If for cold climates, the boards are doubled or covered outside with tiles or hurdle work filled in with clay.

14,312, Cement Briquettes. T. Arnold.

By this invention the briquettes are moulded in a dry state under heavy pressure. Water is then added and absorbed by the briquette, the object of this being to avoid the formation of air bubbles and consequent weakness of the briquette.

NEW APPLICATIONS FOR PATENTS.

July 22.—10,244, J. Rigby, Cement.—10,250, C. Rogers, Wood Screws.—10,281, Q. Backus, Combined Stoves and Chimneypieces.

July 23.—10,284, J. Wilson, Walls, Buildings, Flooring, &c.—10,292, J. Rhodes, Door-bolts.—10,324, W. Matthews, Portland Cement.

July 25.—J. Phillips, Ventilation of Sewers.

July 26.—10,377, W. Youlten, Fireproof Floor Construction.—10,380, T. Duncan and D. Mills, Brazing Band-saws, &c.

July 27.—10,426, T. Moore, Lifters and Fasteners for Skylights, Window-sashes, &c.—10,446, C. Howe, Plaster of Paris.—10,449, P. Beetle, Boring Bits.—10,461, T. Bray, Syphon Water-waste Preventer Cistern for Water-closets.

July 28.—10,493, H. Howse and H. Howse, jun., Combined Door Spring and Buffer.—10,511, W. Swettenham, Flushing Apparatus for Water-closets.

PROVISIONAL SPECIFICATIONS ACCEPTED.

8,585, H. Johnson and T. Wilson, Ventilators.—8,660, E. Verity and Others, Attaching Combined Springs and Air Checks to Doors, &c.—9,099, T. Weston, Wood Screw.—9,434, J. Easley, Automatic Apparatus for Dry-closets and Water-closets.—9,489, W. Lee, Circular Saw Spindles.—9,622, J. Jones, Concrete Pavements, Floors, &c.—4,300, A. McKechnie and G. Wicks, Plumbers' Traps.—8,678, A. Caldow, and J. Burnett, Warming and Ventilating Buildings, &c.—8,849, S. Bastow, Door Cramp.—9,448, H. Allen, Service Cistern for Water-closets.—9,783, A. Bayer and C. Mott, Cramp for Flooring and Woodwork.—9,815, A. Douglas Hamilton, Cowls or Wind-guards.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to Opposition for Two Months.

9,808, W. Thompson, Plumber's Portable Furnace.—12,189, J. Watkins, Tapes for Measuring round Timber.—2,291, E. Young and G. Bainbridge, Ventilation.—7,755, F. Brenner, Water-supply in Houses.—2,513, R. Little and J. Hall, Timber Roofs.—3,757, W. Pilditch, Hanging Doors and Casements, 7,884, W. Ducker.—Sheathing for Buildings or Structures.—9,172, L. Sagendorph, Machines for Making Metallic Roofing.

RECENT SALES OF PROPERTY.

ESTATE EXCHANGE REPORT.

July 25.

By E. Robins & Hine.

Brixton—Ground-rent of 1,000*l.* a year, reversion in 96 years £2,500

By G. A. Wilkinson.

Englefield Green, St. Jude's-road—An enclosure of freehold land, 4a. 0r. 36p. 1,680
Woolwich—A plot of land, with erections thereon, area 38,370 ft., freehold 5,100
5 to 9 and 14, Harden's-lane, and a plot of land, freehold 680
A plot of Freehold land, with erections thereon, area 37,000 ft. 3,500
Glass-yard—A coal store and stabling, 55 years, ground-rent 5*l.* 145

By Fuller, Moon, & Fuller.

Mitcham—A plot of land, 4 acres, freehold 1,220
A plot of market garden land, 1a. 1r. 10p. 200

By Robinson & Rudkin.

Beckenham—13, Ravenscroft-villas, freehold 200
Bow—80, St. Paul's-road, 72 years, ground-rent 5*l.* 310
Eltham—81, High-street, and 2 and 3, Court-yard, freehold 990
The residence, Whitworth House, and two shops, freehold 1,235
1a, and 1, 2, and 3, Elizabeth-terrace, freehold ... 715
7, 8, and 17 to 24, Elizabeth-terrace, freehold 1,620
Eleven freehold cottages in Sun-yard 325
Ground-rent of 3*l.* 10s. in perpetuity 70
4 to 7, Weston Park, freehold 1,310
11, Weston Park, 49 years, ground-rent 12*l.* 10s. 200
Ground-rent of 12*l.* 10s., reversion in 49 years ... 250
Ground-rent of 3*l.* 15s., reversion in 57 years 75
Ground-rent of 4*l.* 5s., reversion in 44 years..... 110
Ground-rent of 21*l.* in perpetuity 480

By Pettitt, Son, & Byrne.

Westminster—19 and 20, New-street, 74 years, ground-rent 10*l.* 430

July 26.

By Broad & Wiltshire.

New Cross-road—No. 288, term 54 years, ground-rent 10*l.* 15s. 550
Caledonian-road—No. 306, term 57 years, ground-rent 5*l.* 730

By T. Turner.

Lisson-grove—84, Earl-street, 28 years, ground-rent 6*l.* 6s. 300
Paddington—73, Hall-place, 51 years, ground-rent 7*l.* 7s. 420
Kensington—4, William-street, 62 years, ground-rent 5*l.* 320

By H. Rutley.

Tottenham-court-road—The lease of 87 and 89, Whitfield-street, term 41 years 705
Oakley-square—37, Charrington-street, 36 years, ground-rent 5*l.* 5s. 505

By A. & A. Field.

Bethnal-green—68 and 70, Royston-street, 35 years, ground-rent 6*l.* 340
Stepney-green—18, Copley-street, 55 years, ground-rent 4*l.* 320

By A. Richards.

Fulham, Peterborough-lane—Vine Cottage and Holly House, freehold 700
Tottenham, Northumberland Park—Windsor Lodge, 82 years, ground-rent 10*l.* 350
Enfield Highway—4, Hope-cottages, freehold 180
Enfield—12 and 13, Goat-road, freehold 300

By Debenham, Tewson, & Co.

Essex, near Haverhill—Great and Little Walton's Farm, 300a. 0r. 17p., freehold 5,600
Broad Green Farm, and 127a. 1r. 25p., freehold... 1,700
Great Norton's Farm, 129a. 0r. 20p., freehold and part copyhold 950
The Lion Hotel, and 2a. 0r. 30p., freehold 1,025
Enclosures of land, 11a. 2r. 26p. 615
Two cottage residences 700
Freehold allotment gardens, 7a. 0r. 18p. 305
Stoke Newington—Ground-rents of 28*l.*, reversion in 98 years 700

By B. Brown.

Limehouse, Crawford-street—A freehold site, area 6,300 ft. 800

By Rogers, Chapman, & Thomas.

South Kensington—40, Elm Park-gardens, 87 years, ground-rent 2*l.* 1,630

By Thurgood & Martin.

Belgravia—23 to 29 odd, Belgrave-road, 40 years, ground-rent 20*l.* 6,320
31, Belgrave-road, 40 years, ground-rent 5*l.*..... 1,300
10, 16, and 21, Eaton-square, 37 years, ground-rent 17*l.* 11s. 16,000
16 to 19, 21, 24, 29, 30, and 42, Wilton-crescent, 37 years, ground-rent 89*l.* 43,850
Ground-rents of 572*l.* 14s., term 37 years 11,655

By Dyer, Son, & Hilton (at Deptford).

Peckham—259 and 261, Queen's-road, 54 years, ground-rent 8*l.* 620
190 to 200 even, Queen's-road, 62 years, ground-rent 24*l.* 1,950

July 27.

By J. A. Smith.

Kensington—17, Camden-grove, 56 years, ground-rent 7*l.* £790
Bayswater—14, Garway-road, 33 years, ground-rent 6*l.* 15s. 480

By W. A. Blakemore.

Upton Park—Carlos Cottage, and two plots of land, freehold 1,180
Boleyn-road—Upton House, freehold 165
Sydenham—47, Kent House-road, 78 years, ground-rent 8*l.* 175

By Hobson, Richards, & Co.

Edmonton—1 to 24, Tramway-avenue, 92 years, ground-rent 67*l.* 1,080

By Phillips, Lea, & Davies.

Nunhead—2, Barforth-road, 79 years, ground-rent 6*l.* 330
City—8, Ludgate-hill, 23 years, ground-rent 9*l.*..... 4,210
Southend—13, Prittlewell-square, 71 years, ground-rent 5*l.* 910

By Furber, Price, & Furber.

Bermondsey, Upper Grange-road—Ground-rent of 28*l.* 16s., reversion in 13½ years 1,430
Ground-rents of 5*l.* 5s., reversion in 23½ years..... 175
Ground-rent of 27*l.*, reversion in 24½ years 1,035
126 to 132 even, Long-lane, freehold 1,595
King's-cross, Copenhagen-street—Ground-rent of 14*l.* 1s., reversion in 18 years 730
Copenhagen-street—Ground-rent of 19*l.*, reversion in 18 years 1,000
Buckingham-street—Ground-rent of 30*l.*, reversion in 27 years..... 885
Buckingham-street—Ground-rent of 45*l.*, reversion in 30 years 1,160
Buckingham-street—Ground-rent of 4*l.* 10s., reversion in 18 years 165
8, 12, and 14, Buckingham-street, freehold 1,115
43, Brewery-road, 60 years, ground-rent 6*l.* 550

July 28.

By D. Watney & Sons.

Tunbridge Wells—The freehold residence called Broomhill Bank, and 124a. 3r. 2p..... 15,000
Brighton—9 and 10, Second-avenue, freehold 6,800

By C. C. & T. Moore.

Romford-road—The freehold residence, St. Helen's 1,000
Bethnal-green—70 and 72, Arbery-road, 64 years, ground-rent 11*l.* 555

By Fleuret & Son.

Islington—32, 36, 38, and 42, Essex-street, freehold 2,690
Barnes—1, Castlenau-gardens West, 42 years, ground-rent 5*l.* 380
Bloomsbury—13 and 14, Lascelles-place, 12 years, ground-rent 40*l.* 130

By H. C. Wood.

Southwark Park-road—Nos. 331 and 333, 30 years, ground-rent 7*l.* 4s. 30

By Perkins & Cesar.

Southwark—9, Maze-pond, freehold 405

By C. D. Field & Sons.

Borough—37, High-street, freehold 2,940

By Inman & Co.

Kilburn—10, Goldsmith-place, 57 years, ground-rent 6*l.* 480

By H. J. Bliss & Sons.

Bethnal-green—2 and 3, Albert-road, 67 years, ground-rent 5*l.* 630
5 and 6, Albert-road, 68½ years, ground-rent 6*l.* ... 575
Hackney—7 to 14, Cross-street, 69 years, ground-rent 26*l.* 1,130

By E. Stimson.

Lambeth—99, 101, and 103, Vauxhall-walk, 55 years, ground-rent 10*l.* 650
Old Charlton—15, 17, and 18, Victoria-road, 54 years, ground-rent 22*l.* 6s. 1,240
Kennington-road—124 and 125, Prince's-road, 21½ years, ground-rent 13*l.* 8s. 290
Denmark-hill—20, Daneville-road, 75 years, ground-rent 5*l.* 10s. 380
16, Selborne-road, 75 years, ground-rent 5*l.* 10s.... 300

By Newson & Harding.

Hackney—42, Gore-road, 66 years, ground-rent 7*l.* 345
Upper Holloway—28 to 40 even, Brunswick-road, freehold 1,370
Prospero-road—Freehold land, 2a. 3r. 18 p. 3,300

By W. Edymann & Son.

Acton—2 to 8 even, Grove-place, freehold 870
62, 64, and 99, Park-road North, freehold 1,745
101, 103, and 105, Park-road North, freehold 860
34, 36, and 38, Osborne-road, freehold 1,600
74 and 76, Bollo Bridge-road..... 330
The Gladstone public-house, freehold 3,100
Saville-road—Two plots of freehold land 130

July 29.

By St. Quintin & Son.

Mitcham—A plot of copyhold land, 1a. 2r. 16p..... 150

By F. C. Kettle.

Epping, Station-road—The freehold residence, Laurel Bank 1,550

By Debenham, Tewson, & Co.

Worcester Park, Avenue-road—The Bungalow, with stabling, and 2a. 2r. 23p. 1,500
2, Redcross-road, freehold 360
Hyde Park—38, Southwick-street, 43 years, ground-rent 11*l.* 830
6, Porchester-place, 48 years, ground-rent 10*l.* 10s. 1,100
Clapham—9, The Pavement, 19 years, ground-rent 60*l.* 800
Shepherd's-bush—57, The Lawn, 4 years, ground-rent 6*l.* 6s. 100

By Prickett, Venables, & Co.

Ponder's End, South-street—Freehold residence ... 1,030
Highgate—15, Cromwell-place, 94 years, ground-rent 10*l.* 10s. 800

By Buckland & Co.

South Kensington—10, Prince's-gardens, 57 years, ground-rent 70*l.* 10,000

By Reynolds & Eason.

Bexley Heath, North-street—A plot of freehold land 80
1 and 2, Leamington-villas, freehold 350
1 and 2, Warwick-villas, freehold 315

MEETINGS.

SATURDAY, AUGUST 6.

Royal Archæological Institute (Salisbury Meeting).—Excursion to Wardour Castle, Tisbury Church, Wilton House and Church. Sectional Meetings in the evening.

MONDAY, AUGUST 8.

Royal Archæological Institute (Salisbury Meeting).—Excursion to Boyton Church and Manor House, Scratchbury Camp, Heytesbury Church, Knook Church, and Heytesbury House. Sectional Meetings in the evening.

Clerks of Works' Association (Carpenters' Hall, London Wall).—Mr. Linn Dillon on "Technical Education and its bearing on Clerks of Works." 8 p.m.

TUESDAY, AUGUST 9.

Royal Archæological Institute (Salisbury Meeting).—Excursion to Farnham Museum, Woodcutts (Romano-British) Village to Rushmore, returning by way of Rotherly Wood (Romano-British) Village, Winklebury Camp, and Ferne. (Concluding day.)

SATURDAY, AUGUST 13.

Architectural Association. — Visit to the Seat of Mr. B. W. Currie, near Farnborough, Hants. (See advertisement on p. xvi.)

Miscellanea.

The Sanitary Condition of Margate.—Margate and its sanitary condition continues to engage public attention, and the Town Council have published a report by Professor Corfield on the mortality returns of the borough during the six months ended June 30th of the present year. The report shows "that the borough has been during the past half-year remarkably free from zymotic disease of any kind"; but no one is content with this fact if Margate retains conditions which are liable at any moment to be a source of danger to the inhabitants and visitors. Families visiting the seaside for the benefit of their health do not desire to inhale the exhalations from hundreds of cesspools, however much these may be diluted by the sea breezes. Last year showed Margate to be the seat of a considerable prevalence of typhoid fever, and the town still has about it all the conditions to foster this disease. It would be a misfortune if the public mind were quieted before the Town Council have recognised the necessity of performing the most elementary duties of a sanitary authority, viz., the provision of a safe water supply and of a proper system of excrement disposal. As a mere matter of pecuniary investment, the necessary outlay would have an ample return in the security it would give to the health of the many persons who annually frequent this locality. Until the Town Council have fully complied with the recommendations contained in Dr. Page's report to the Local Government Board, and are able to assert that the conditions which are therein properly condemned no longer exist, it is impossible for intending visitors to think of Margate as a town in which proper precautions are taken to secure them from disease.—*Lancet.*

The Health of Ramsgate.—The Medical Officer of Health for Ramsgate, in his half-yearly report to the Sanitary Authority, stated that the birth-rate of the borough was 25·6, the death-rate 14·3, and the death-rate from zymotic diseases ·3 per 1,000 for the past six months. He reported that the general sanitary condition of the town was good, and that there was a marked absence of those diseases which are attributed to defective drainage. He considered that the satisfactory state of the district was due to the completion of the extensive new drainage works, and to the alteration of the sewer outfall, which together cost the town upwards of 20,000*l.*, and which must still further enhance its salubrity, although it has long been one of the healthiest towns in the kingdom.

Iron, Hardware, and Metal Trades' Pension Society. — At the semi-annual general meeting of this Society, held at the offices in London last week, the following pensioners were elected, viz.:—Men (four): George Brown, Rotherham, 660 votes; Richard Farmer, London, 650; John Bettridge, London, 538; and John Finch, London, 480. Women (two): Charlotte McKenzie, Birmingham, 2,504; and Mary Aldous, London, 2,070. Mary Hollely, Sheffield, being the highest unsuccessful candidate, received the Falkirk Iron Company's gratuity of 5*l.* 5s. John Bettridge was awarded a pension of 20 guineas; the remaining five received pensions of 25 guineas, they or their late husbands having been subscribers to the Institution.

Perry & Co., Limited.—The directors of this company have resolved to pay on the 1st September, out of profits, an interim dividend on the ordinary shares for the first six months of this year at the rate of 6 per cent. per annum, free of income tax, being at the same rate as for the corresponding period last year.

The Belgian Girder Competition.—The Belgian girder competition question has just taken an important turn which should be to the advantage of English makers. Excitement exists among buyers at the circumstance that the prices of Belgian, French, and German rolled joists delivered into this country have just been advanced about 10s. per ton, the result of the increased number of orders being received at the works. London importing merchants are also advised that a further advance of 8s. per ton is contemplated, since Continental makers are determined to make the most of the present enlarged demand. The fact that the Continental girder-makers have been getting scarcely any profits during the last year or two had led to the expectation by English merchants that a rise would be declared at the first opportunity. Scarcely any of the Continental companies paid a dividend last year, and the highest that was paid by any one concern was 1¼ per cent. The advanced prices of Belgian rolled joists delivered into the Midlands, if delivered promptly from stock in London, and allowing a small middleman's commission, are:—12 in. by 5 in., lengths to 30 ft., 6*l.* 12s. 6d. per ton, and 10 in. by 5 in., 6*l.* 10s. If consumers are prepared to wait for from five to six weeks for the execution of orders so as to allow of the iron being got direct from the works, the prices are very much lower, namely, 5*l.* 12s. 6d. for 12 in. by 5 in., and 5*l.* 11s. 10 in. by 5 in. Small sizes, such as 6¼ in. by 3¼ in., are about 5*l.* 14s. 6d., brought from stock and delivered into the Midlands. The fact that English ironmasters have given up the manufacture of rolled iron joists in competition with the imported goods, and that they are now confining their attention to rolled steel joists, makes it much easier for the foreigners to command the advances just declared than would have otherwise been the case. English architects are, however, becoming acquainted with the circumstance that native makers are now giving their attention to steel, and are specifying steel joists in building erections. Messrs. Dorman, Long, & Co., Middlesbrough, who have taken the lead as makers, report that they have lately found the demand for steel joists increasing. Prices of English joists of this description delivered into the Midlands are now 6*l.* 15s. per ton up to 8 in. deep, 7*l.* per ton up to 10 in., 7*l.* 5s. up to 12 in., and 7*l.* 15s. up to 16 in., which is the maximum size at present manufactured.—*Iron.*

Local Government Board Inquiry at Birmingham.—An inquiry was held at the Council House, Birmingham, on the 27th ult., by Mr. J. D. Harrison, to consider an application by the Corporation to borrow 6,000*l.* for sewage purposes. The Town Clerk, in supporting the application, said the money was required to construct a sewer which was necessary to prevent a great difficulty that had been experienced with regard to the flooding of a portion of the borough. The proposed sewer would commence at the River Rea, and the storm-water would pass into it, near Montague-street Wharf, and from this point would be continued through the Corporation Wharf, along Glover-street, Bond-street, Bordesley, along the Midland Railway Embankment, and terminating in Lawden-road, at which point it would be connected with the brook course. It would not, however, have any influence with the brook's course, except during heavy flooding. The Borough Surveyor (Mr. Till), in exhibiting the plans, said he had seen water lying to a depth of 2 ft. 6 in. above the roadway. The full length of the proposed sewer would be 1,667 yards, and of these 1,035 yards would have a diameter of 4 ft. and 632 yards a diameter of 3 ft. 6 in. Mr. Till said that a provisional arrangement had been made with the Midland Railway Company, and the Warwick Canal Company would have no cause for complaint, as the proposed sewer would benefit their property. In answer to Mr. Pollock, of London, who acted on behalf of Lord Norton, Mr. Till said it was not intended to connect the new sewer with any other sewer. The Inspector said he quite understood that the new sewer would be perfectly distinct from the ordinary sewage system, and would only carry storm water. In answer to another question, Mr. Till said he did not intend to have storm outlets in the course of the sewer. The Borough Treasurer, in answer to the Inspector, stated that the population had increased by 25,000 since 1881, and that the loans borrowed under the Sanitary Act amounted to 969,853*l.*, of which sum 144,799*l.* had been paid off. The Inspector thought the work proposed to be done was very necessary, and after a vote of thanks to him the proceedings terminated.

The High School for Girls, Stroud Green, which has been erected here for Miss Emily Mills, was opened on Tuesday afternoon, the 26th of July. The design is an adaptation of the "Queen Anne" style. The walls are of yellow bricks, with red dressings and arches, relieved with a light brown stone from the New Biggen quarries; and the gables are finished in rough cast ornamental plaster, upon which is worked the date of the foundation and the title of the school. Over the side porch for pupils is carved the motto of the school, "Doe ye nexte thynge." The school contains accommodation for 300 scholars, in four large apartments known as the lecture-hall and third-form room on the first floor, and gymnasium and kindergarten-room on the ground-floor, in addition to which there are three music or class-rooms and a dressmaking-room, also housekeeper's rooms, cellarage, and other domestic offices, principal's room, dressing-room, and lavatory for professors on each floor, and a bath-room, each fitted with hot and cold water. The total cost of the building and fittings has been 2,400*l.*, or 8*l.* per scholar. The building was designed by Mr. W. S. Wilson, in conjunction with Mr. J. W. Stevens. The work has been carried out by Messrs. Lansdowne & Co., of Richmond, Surrey. Mr. Ragless, of Hornsey-road, has executed the internal school fittings.

The Home of Mercy, Lostwithiel.—The Home of Mercy stands upon rising ground over and above this pretty Cornish town, and commands a superb view. It was built some twenty years ago from the designs of the late George Edmund Street, R.A., and attached to it is a chapel dedicated to St. Faith. Some few years ago a special gift was made to this chapel in the shape of a fine reredos in polished alabaster and marbles, designed by Mr. R. Medley Fulford, F.R.I.B.A., architect, of Exeter, and made by Mr. Harry Hems, of the same city. Additions to this reredos have just been made at either side. Niches have been placed in the east wall, within which stand life-sized statues of SS. Peter and Paul respectively. They are set upon corbels held up by angels. The canopies are delicately groined, and terminate with lofty crocketed spires. The new work, like the surroundings, is of early character, designed by Mr. Fulford and carried out in its entirety by Mr. Harry Hems.

A Working Men's Flower Show.—We hear that the Co-operative movement will be well represented at South Kensington on August 23rd, on the occasion of the National Co-operative Flower Show, held under the auspices of the Royal Horticultural Society, which will be an exhibition of the products of *bonâ-fide* working men's gardens, grown from seeds sold in penny packets, through the medium of the twelve hundred co-operative stores which now exist. The show cannot help being interesting and instructive, as it will so thoroughly represent the gardening capabilities of small cottages throughout the length and breadth of the land. Cheap excursions are being organised from all parts of the kingdom, and the Conference, which is to be held in the afternoon on the "Possibilities of Co-operative Allotments and Associated Gardens," will doubtless be well attended, and give rise to an interesting discussion.

Road Surveyors' Association for Scotland.—A meeting of this Association was held within the pavilion of the Highland and Agricultural Society at Perth, on the 28th ult., at which there was a large attendance. Mr. Mitchell, Dundee, President, occupied the chair. The office-bearers elected for the ensuing year were, Mr. Rankin, Carronbridge, President; Mr. McLennan, Dunfermline, and Mr. Laidlaw, Linlithgow, Vice-Presidents; Mr. Stevenson, Ayr, Secretary and Treasurer. After the ordinary business had been completed, papers on "Bridges and Culverts," by Mr. Aitken Cupar, and "Amendments suggested on the Road Act," by Mr. Laidlaw, were read and discussed.

Romano-British Remains. — The new volume of the "*Gentleman's Magazine* Library," to be issued by Mr. Elliot Stock immediately, will contain the completion of the section on "Romano-British Remains." In it we are promised a record of the discoveries of Roman remains in all parts of the country, classified into counties.

Northern Architectural Association.—On Monday a number of the members of this Association, including Mr. G. G. Hoskins, F.R.I.B.A., president; Mr. W. Glover, vice-president; and Mr. Frank W. Rich, hon. sec., visited Castle Howard, near Malton, Yorkshire, one of the seats of the Earls of Carlisle. The mansion, the design of Sir John Vanbrugh, was commenced in 1702, and, with the exception of the west wing, was completed by him. The entertaining rooms are small, but for the comfort and convenience of the house as a habitation many improvements have been made since the time of Vanbrugh. The members, after making an inspection of the building, viewing the valuable collection of pictures, and taking photographs of the north and south façades, returned to Malton for dinner, and thence left by train for Newcastle.

Architectural Association. — Messrs. Herbert S. Wood, Herbert G. Lidstone, and H. V. Lanchester have been awarded the first, second, and third prizes respectively in the examination held in June last, in connexion with Mr. H. Lovegrove's lectures on "Construction," at the Architectural Association.

PRICES CURRENT OF MATERIALS.

TIMBER.	£.	s.	d.	£.	s.	d.
Greenheart, B.G. ....ton	5	10	0	7	10	0
Teak, E.I. ....load	8	0	0	12	0	0
Sequois, U.S. ....foot cube	0	2	3	0	3	0
Ash, Canada ....load	3	0	0	4	10	0
Birch ,, ...load	2	0	0	3	10	0
Elm ,, ...load	3	10	0	4	10	0
Fir, Dantsic, &c. ....load	1	10	0	4	0	0
Oak ,, ...load	2	10	0	4	10	0
,, Canada ....load	3	0	0	6	0	0
Pine, Canada red ....load	2	0	0	3	10	0
,, yellow....load	2	10	0	4	10	0
Lath, Dantsic ....fathom	3	0	0	5	0	0
,, St. Petersburg ....fathom	4	0	0	5	10	0
Wainscot, Riga ....log	0	0	0	0	0	0
,, Odessa, crown....load	2	10	0	3	0	0
Deals, Finland, 2nd and 1st...std.100	7	0	0	8	0	0
,, 4th and 3rd....std.100	5	10	0	6	10	0
,, Riga std.100	5	10	0	7	0	0
,, St. Petersburg, 1st yellow std.100	8	0	0	13	0	0
,, 2nd ,, ...std.100	7	0	0	8	0	0
,, white std.100	6	10	0	8	10	0
,, Swedish std.100	0	0	0	0	0	0
,, White Sea std.100	7	0	0	16	0	0
,, Canada, Pine, 1st std.100	16	0	0	24	0	0
,, ,, 2nd....std.100	10	0	0	15	0	0
,, ,, 3rd, &c....std.100	6	0	0	9	0	0
,, Spruce, 1st std.100	8	0	0	9	0	0
,, ,, 3rd and 2nd std.100	5	0	0	7	0	0

TIMBER (*continued*).	£.	s.	d.	£.	s.	d.
New Brunswick, &c....load	5	0	0	8	10	0
Battens, all kinds ....load	4	0	0	10	10	0
Flooring Boards, sq., 1 in., prepared, First ....square	0	8	0	0	11	0
Second ....square	0	6	6	0	7	6
Other qualities ....square	0	4	0	0	6	0
Cedar, Cuba ....foot	0	0	3½	0	0	3½
Honduras, &c. ....foot	0	0	3	0	0	3½
Australian ....foot	0	0	2	0	0	3
Mahogany, Cuba ....foot	0	0	4	0	0	7
St. Domingo, cargo average ....foot	0	0	4	0	0	6
Mexican ,, ...foot	0	0	3½	0	0	4
Tobasco ,, ...foot	0	0	4	0	0	5½
Honduras ,, ...foot	0	0	3½	0	0	5½
Maple, Bird's-eye ....foot	0	0	5	0	0	7
Rose, Rio ....ton	8	0	0	11	0	0
Bahia ....ton	7	0	0	9	0	0
Box, Turkey ....ton	5	0	0	12	0	0
Satin, St. Domingo ....foot	0	0	5	0	0	9
Porto Rico ....foot	0	0	6	0	0	10
Walnut, Italian ....foot	0	0	3½	0	0	5½

METALS.						
Iron—Bar, Welsh, in London...ton	4	7	6	4	15	0
,, ,, in Wales ....ton	4	2	6	4	7	6
,, Staffordshire, London ....ton	5	10	0	6	0	0
Sheets, single, in London ....ton	8	15	0	8	10	0
Hoops ,, ...ton	6	0	0	7	0	0
Nail-rods ,, ...ton	5	15	0	6	10	0
Copper—						
British, cake and ingot ....ton	43	15	0	44	0	0
Best selected ....ton	44	10	0	45	10	0
Sheets, strong....ton	50	0	0	0	0	0
Chili, bars ....ton	39	17	6	40	5	0
Yellow Metal ....lb.	0	0	0	0	0	0
Lead—						
Pig, Spanish ....ton	12	2	6	12	3	9
English, common brands....ton	12	10	0	0	0	0
Sheet, English ....ton	13	7	6	13	13	9
Spelter—						
Silesian, special ....ton	14	12	6	14	15	0
Ordinary brands....ton	14	10	0	14	12	6
Tin—						
Straits....ton	105	10	0	0	0	0
Australian ....ton	105	10	0	0	0	0
English ingots ....ton	108	5	0	0	0	0
Zinc—						
English sheet ....ton	0	0	0	0	0	0

OILS.						
Linseed ....ton	20	10	0	20	12	6
Cocoanut, Cochin ....ton	30	0	0	33	0	0
Ceylon ....ton	24	0	0	0	0	0
Palm, Lagos ....ton	20	0	0	20	10	0
Rapeseed, English pale ....ton	22	15	0	23	0	0
,, brown ....ton	21	5	0	20	10	0
Cottonseed, refined ....ton	20	10	0	21	0	0
Tallow and Oleine....ton	25	0	0	45	0	0
Lubricating, U.S. ....gal.	5	0	0	6	0	0
,, refined ....gal.	5	0	0	12	0	0
Turpentine—						
American, in casks ....cwt.	1	5	9	0	0	0
Tar—						
Stockholm ....barrel	0	14	0	0	14	6
Archangel ....barrel	0	9	6	0	10	0

COMPETITIONS AND CONTRACTS.

Epitome of Advertisements in this Number.

COMPETITIONS.

Nature of Work.	By whom required.	Premium.	Designs to be delivered.	Page.
Swimming, Private, and Turkish Baths.....	Gloucester Cor.....	50*l.* and 25*l.*.....	October 1st	i.

CONTRACTS.

Nature of Work, or Materials.	By whom required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Erection of Shelters, &c.....	Eastbourne Cor.	*Official*.....	August 8th	i.
Painting and Pointing Works	Chelsea Vestry	do.	August 9th	ix.
Formation of Footpaths, Fencing, &c.	Met. Board of Works...	do.	do.	i.
Asphalting, Tarpaving, Metalling, &c.....	Lewisham Bd. of Wks.	do.	do.	ii.
Semi-Dividing Buildings, Alterations, &c.	Brighton Town Council	P. C. Lockwood	August 15th	ii.
Hot-Water Pipes, &c.	do.	do.	do.	ix.
Paving Works	Brentford Local Board	— Lacey	August 16th	ix.
Renewal of Two Draw-Bridges	War Department.....	*Official*	August 20th	ix.
Collection of Refuse	Tottenham Local Board	do.	August 23rd	ix.
Four Beam Pumping Engines	Leicester Corporation	do.	August 25th	ii.
Stoneware Pipe Sewer, &c.....	Walthamstow Local Bd.	H. S. Ridings.....	August 26th	ii.
Cast-Iron Outfall Sewer	Lymington Local Board	J. Lemon.....	August 30th	ix.
Sewers, Deposit Tanks, &c.	Ashford Local Board ...	*Official*	Sept. 7th	ii.

TENDERS

ANDOVER.—For mansion and offices, Enham Place, near Andover. Mr. S. Knight, F.R.I.B.A., architect. Quantities supplied by Messrs. Stoner & Sons :—

Luscombe & Son, Exeter	£7,800	0	0
Bird, Edgware-road, London	7,525	0	0
Estcourt, Gloucester	7,431	0	0
Grover & Son, Islington, London ...	7,088	0	0
Stephens, Bastow, & Co., Bristol and London (accepted)	6,849	0	0
Beale, Andover	6,528	0	0

ASHTON-ON-MERSEY. — For a reading-room at Ashton-on-Mersey, for Sir William Brooks, bart., M.P. Mr. George Truefitt, architect, 5, Bloomsbury-square, W.C. :—

Benjamin Haywood	£1,782	2	10
Southern & Sons	1,462	0	0
Cross & Bell	1,395	0	0
Wilson, Toft, & Huntley (accepted)	1,386	0	0

BERMONDSEY.—For repairs to roofs and parapet walls, at the Bermondsey Workhouse, for the Guardians of St. Olave's Union. Messrs. Newman & Newman, architects, Tooley-street, London Bridge :—

Chafen	£480	0	0
White	397	0	0
Greenwood	377	0	0
Stephens	375	0	0
Potton	360	0	0
Bullers	354	0	0
Shepherd	300	0	0
Pritchard (accepted)	290	0	0

BRISTOL.—For taking down kilns, stacks, buildings, and clearing the site of New Day Industrial School, for the Bristol School Board, under the supervision of Messrs. J. W. Trew & Sons, Broad-street, Bristol :—

	Credit.	Debit.
Renolds	—	£200 0 0
Turner.....	—	147 0 0
Ridewood	—	120 0 0
Balmont	£55 0 0	—
Hollbrook (accepted)	87 10 0	—

[All of Bristol.]

BRISTOL.—For Easton-road Board School, Bristol. Messrs. Hansom & Bond, architects, Clifton, Bristol. Quantities supplied :—

Cowlin & Son.....	£5,170	0	0
W. Church.....	4,995	0	0
Eastabrook & Sons	4,959	0	0
G. Humphreys	4,943	0	0
H. A. Forse	4,930	0	0
Stephens & Bastow	4,679	0	0
Howell & Son	4,650	0	0
S. Turner.....	4,570	0	0
J. E. Davis	4,567	0	0
J. Wilkins & Son	4,550	0	0
A. J. Beaven	4,390	0	0
J. Perrott	4,324	0	0
T. R. Lewis (accepted)	4,290	0	0

BROMLEY (Kent).—For new road, Queen's Mead, Bromley, Kent, for the Bromley Local Board. Mr. Hugh S. Cregeen, surveyor :—

J. G. B. Marshall	£999	0	0
J. Mowlem & Co.....	785	0	0
T. Lansbury	780	10	0
Woodhams & Fry	769	0	0
A. J. Cattley.....	744	0	0
E. Peill & Sons (accepted)	744	0	0

BUNTINGFORD (Herts).—For alterations to two houses, for Mr. T. J. Sworder. Mr. Russel Austin, C.E., Hertford :—

Willmott & Son	£605	0	0
F. Cates	455	0	0
T. Nevett *	447	0	0

* Accepted subject to reduction.

CARLISLE.—For house and shops, Hart and Broad streets, for Mr. S. Neilson. Mr. H. Higginson, architect, Carlisle and Preston :—

Bricklayer and Mason.			
G. Hill	£222	12	0
Carpenter and Joiner.			
W. Latimer	110	0	0
Slater.			
M. Newson	13	0	0
Plumber.			
G. Sowerby	10	10	6
Plasterer.			
S. Ferguson	18	0	0
Painter and Glazier.			
H. Harkness	14	14	6

FINSBURY.—For erecting new water-closets for the boys and girls at the Penton-grove school (Finsbury AI), and for erecting a wall (in lieu of the present railing) to enclose the playgrounds, for the School Board for London. Mr. T. J. Bailey, architect :—

W. Howie	£604	16	7
Davis Bros.	566	0	0
J. Wells & Son.....	332	0	0
C. Dearing & Son *	268	0	0

* Recommended by the Works Committee for acceptance.

HACKNEY.—For removing the old water-closets at the Bonner-street school (Hackney O2), and erecting new water-closets for boys, girls, and male infants, at a further distance from the school, for the School Board for London. Mr. T. J. Bailey, architect :—

W. Howie	£658	18	0
Davis Bros.	587	0	0
W. Johnson *	328	0	0

* Recommended by the Works Committee for acceptance.

ISLINGTON.—For laying down new granite carriageways, York stone footways, and about 143 ft. in length of 18-in. pipe sewer, and executing other works in connexion therewith, for the purposes of widening Upper-street, Islington, for the Metropolitan Board of Works. Sir J. W. Bazalgette, engineer :—

Nowell & Robson	£8,475	0	0
Thomas Adams	8,191	0	0
H. R. Trehearne	8,169	0	0
J. J. Bigge.....	8,150	0	0
J. J. Griffiths.....	7,684	0	0
G. G. Rutty	7,487	0	0
J. Mowlem & Co. (accepted)	6,900	0	0

KIRKHAM.—For the erection of a Wesleyan school. Mr. H. Higginson, architect, Carlisle and Preston :—

Croft, Preston	£889	0	0
Smith, Blackpool.....	825	0	0
Riley, Fleetwood.....	817	3	4
Baldwin, Preston	786	0	0
Gardner, Kirkham	779	0	0
Singleton, Kirkham	760	0	0
Haslam, Kirkham (accepted)	718	10	0

LAMBETH.—For the erection of temporary school buildings, on the Victoria-road site (East Lambeth X), for the School Board for London. Mr. T. J. Bailey, architect :—

F. Brady & Co., Limited	£2,580	0	0
C. Kent	1,390	10	0
Croggon & Co.	1,255	0	0
W. Harbrow	1,183	0	0
North & Son	1,163	0	0
I. Dixon & Co.	1,152	0	0
G. B. Ash	1,105	0	0
J. Lysaght & Co., Limited	1,080	0	0
T. Bendon *	1,073	0	0

* Recommended by the Works Committee for acceptance.

LAMBETH.—For rebuilding the infants' water-closets at the New Park-road school (West Lambeth AJ), for the School Board for London. Mr. T. J. Bailey, architect :—

J. W. Roy.....	£139	0	0
E. Triggs	130	0	0
King Bros. & Co.*	121	0	0

* Recommended by the Works Committee for acceptance.

LONDON. — For alterations to the Mitre Hotel, Chancery-lane, for Mr. W. Drew. Mr. H. J. Newton, architect, 17, Queen Anne-gate, Westminster :—

J. Woodman	£333	10	0
Jackson & Todd	318	0	0
F. Mark	299	0	0

LONDON.—For alterations and additions to the office of the English and Scottish Law Life Assurance Association, 12, Waterloo-place, S.W. Mr. Mark H. Judge, architect, 8, Park-place Villas, W.:—

Albert C. Bolding	£3,200	0	0
Hampton & Sons	2,945	0	0
Joseph Hume	2,695	0	0
Charles Earle	2,394	0	0
H. Toten & Sons	2,200	0	0
Wm. King & Son,* Pimlico	1,740	0	0

* Accepted.

LONDON.—For pulling down and rebuilding No. 16, York-street, Covent-garden, for Mr. J. Galsworthy. Messrs. William Reddall & Son, architects and surveyors, South-street, Finsbury:—

Clarke & Bracey	£1,171	0	0
Wm. Brass & Son	1,110	0	0
Hall, Beddall, & Co.	1,092	0	0
Woodward	1,070	0	0
Nightingale	1,033	0	0
Killby & Gayford	1,030	0	0
S. G. Bird	988	10	0
J. Sanders & Sons	986	0	0

LONDON.—For alterations to 39, Porchester-terrace, Hyde Park, for Mr. S. Scarboro Johnson. Mr. W. Hilton Nash, architect:—

J. Waddington (accepted)	£466	0	0

LONDON.—For gasfitters' works, at the Star and Garter, Kingsland-gate:—

Buckley & Beach	£208	0	0
J. Biggs	200	0	0
W. Winn (accepted)	195	0	0

MARYLEBONE.—For erecting a new staircase, &c., for the Pupil Teachers' Centre, on the Brecknock site (Marylebone Q), for the School Board for London. Mr. T. J. Bailey, architect:—

T. Lye	£279	0	0
G. Wilkinson & Sons*	260	0	0

* Recommended by the Works Committee for acceptance.

NEWMARKET.—For house and offices at Newmarket, for Mr. C. Loutes. Messrs. Holland & Son, architects:—

Kerridge & Shaw	£1,898	0	0
King	1,704	18	0
Blyth & Hunt	1,611	0	0
Mills	1,600	0	0
Linzell	1,579	0	0
Hook & Tebbitt	1,557	17	0
Plummer	1,435	0	0
Mason & Son (accepted)	1,300	0	0
Saint & Sons (withdrawn)	1,050	0	0

NUNHEAD.—For the erection of two iron buildings on the site in Ivydale-road, Nunhead (East Lambeth AG), for the School Board for London. Mr. T. J. Bailey, architect:—

Walker Bros.	£895	0	0
Clark, Bunnett, & Co.	850	0	0
Croggon & Co.	848	0	0
North & Son	818	0	0
J. W. Roy	805	0	0
W. Harbrow	765	5	0
A. W. Pocock	670	0	0
Bruce & Still*	630	0	0

* Recommended by the Works Committee for acceptance.

PORTSMOUTH.—For building St. Michael's Vicarage. Mr. Withers, architect. Quantities by Mr. Hale:—

Mullings, Devizes	£2,484	0	0
Dove Brothers, London	2,415	0	0
Burrell, Littlehampton	2,329	0	0
Stephenson, London	2,285	0	0
Gregory & Co., London	2,237	0	0
W. & R. Light, Portsmouth	2,227	0	0
J. & C. Bowyer, Norwood	2,197	0	0
Spear & King, Crowthorne	2,193	0	0
Buckle & Wheeler, Abingdon	2,185	0	0
Bottrill, Reading	2,140	0	0
Smith, Worthing	2,123	0	0
Stevens & Bastow, Bristol	2,100	0	0
H. & D. Evans, Portsmouth	1,990	0	0
Bull, Sons, & Co., Southampton	1,971	0	0

SOUTH NORWOOD.—For alterations to the Albion Hotel, for Mr. Geo. E. Fage. Mr. W. Hilton Nash, architect:—

Drew & Cadman	£433	0	0
Bryan	298	0	0
Smith	297	0	0
Ovenden (accepted)	247	0	0

WEYBRIDGE.—For new shop and dwelling-house, Baker-street, Weybridge. Mr. W. I. Chambers, architect:—

Martin, Addleston	£977	0	0
S. Wood, Weybridge	880	0	0
W. & A. Browne, Oatlands Park	877	0	0
Peters, Oatlands Park	865	0	0
King, Oatlands Park	840	0	0
S. Brown, Weybridge	780	0	0
A. A. Gale, Woking	650	0	0
Matthews & Mann,* Weybridge	650	0	0

* Accepted.

***** SPECIAL NOTICE.—Lists of Tenders frequently reach us too late for insertion. They should be delivered at our office, 46, Catherine-street, W.C., not later than 12 Noon on THURSDAYS.**

TO CORRESPONDENTS.

Registered Telegraphic Address, "THE BUILDER, LONDON."

T. P. M.—S. H. D.—J. A. G.—C. P.—J. S.J.; E. S. (the advertisers are probably taking the best course for applicants as well as for themselves. It is no benefit to the profession to encourage a totally disproportionate number of people to waste time in competing for a small prize which only one of them can obtain).—B. C. Sons & Co.—J. E. B. & Sons.—A. M. H. (next week).—H. H.—J. W. S.—J. R. (MSS. of papers read should be sent in better form; we cannot undertake to wade through copies of papers badly written and full of mistakes and marginal corrections).

All statements of facts, lists of tenders, &c., must be accompanied by the name and address of the sender, not necessarily for publication

We are compelled to decline pointing out books and giving addresses.

NOTE.—The responsibility of signed articles, and papers read at public meetings, rests, of course, with the authors.

We cannot undertake to return rejected communications.

Letters or communications (beyond mere news-items) which have been duplicated for other journals, are NOT DESIRED.

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